THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

Volume 17 SEPTEMBER, 1938 Number 9

THEODORE AHRENS, 1859–1938

For story, see page 368

ESTABLISHED 1869

B. F. DRAKENFELD & CO.

INCORPORATED

VITRIFIABLE COLORS

Special and Unique Color Shades Prepared to Meet Individual Requirements

OXIDE COLORS—*For WET and DRY PROCESS Porcelain Enamels*

BODY—SLIP—GLAZE STAINS
UNDERGLAZE—OVERGLAZE COLORS
For all Types of Pottery—Tile and Heavy Clay Products

GLASS COLORS—FLUXES—ENAMELS—*For all Types of Glass Decoration*

GOLD . . . SILVER . . . PLATINUM . . . LUSTRE PREPARATIONS

Printing Tissues—Etching Supplies—Oils—Mediums—Banding Wheels—
Brushes—Palette Knives—Perfection Portable Decorating Kilns

**Specialists
In Vitrifiable Colors
Since 1869**

METALLIC OXIDES . . . CHEMICALS

Alumina
Antimony
Arsenic
Barium Carbonate
Bone Ash
Boracic Acid
Borax
Cadmium Carbonate
Cadmium Oxide
Cadmium Sulphide
Cerium Hydrate
Chrome Oxide Green
Clay Vallender
Cobalt Oxide Black
Cobalt Sulphate
Copper Carbonate
Copper Oxides
Drakolene
Drakosett
Epsom Salts
Glass Decolorizers
Iron Chromate
Iron Oxides
Iron Sulphide
Jack Frost
Frosting Compounds
Japanese Ochre Calcined
Lead Chromates
Lepidolite
Manganese Carbonate
Manganese Chloride
Magnesium Carbonate
Manganese Dioxide
Neodymium Oxalate
Nickel Carbonate
Nickel Oxides
Nickel Sulphate
Ochres
Polishing Rouges
Potassium Carbonate
Potassium Chromate
Potassium Bichromate
Powder Blue
Rutile Powdered
Selenium
Sodium Bichromate
Sodium Selenite
Sodium Silico Fluoride
Tin Oxide
Titanium Oxide
Umbers
Uranium Oxide Orange
Uranium Oxide Yellow
Uranium Nitrate
Zinc Oxides
Zirconium Oxide
Whiting

45-7 Park Place, New York

BRANCHES: East Liverpool, Ohio : : Chicago, Illinois : : Works - Washington, Pa.
PACIFIC COAST AGENTS: Braun Corp., Los Angeles : : Braun-Knecht-Heimann Co., San Francisco

THE BULLETIN OF THE AMERICAN CERAMIC SOCIETY

Volume 17 September, 1938 Number 9

CONTENTS

Papers

Application of Dry Mixing in the Whiteware and Refractory Industries—F. A. Fix 351
Expansion Characteristics of Kyanite and Kyanite-Clay Mixtures When Heated—G. R. Pole and D. G. Moore 355

Ceramic History

Theodore Ahrens, 1859–1938 368
Laura Anne Fry: Originator of Atomizing Process for Application of Underglaze Color—K. E. Smith 368
National Ceramic Association Founded 1891—Lida R. McCabe 372
My Experience in the Pottery Business—W. J. Gordy 373

Activities of the Society

New Members 374
Resolutions in Appreciation of W. D. Richardson by Board of Trustees 374
Institute of Ceramic Engineers Announcement 374
Schedule of Meetings 375
Membership Record Chart to August 19, 1938 376
Roster of Corporation Members 377
Roster Changes during August 378
W. J. Rees Visits United States 379
Letters to Editor: Inter-Society Color Council—D. B. Judd 379
International Glass Congress, 1939 381
President's Column: Membership in American Ceramic Society—V. V. Kelsey 382
Americans Are Leaders in Ceramics—R. C. Purdy 382
Report on Fourth Annual Coöperative Art Conference at Blue Ridge College, N. C. 383
Porcelain Enamel Institute Forum—Ceramic Association of New York, Annual Meeting—Officers of Keramos for 1938–1939 384

Advertisers' Index 6

Buyers' Guide 9–12

Publication Office: 20th & Northampton Sts., Easton, Pa.
Editorial and Advertising Office: 2525 N. High St., Columbus, Ohio.
Executive Office: 2525 N. High St., Columbus, Ohio.
Committee on Publications: J. D. Sullivan, *Chairman;* E. E. Marbaker, E. de F. Curtis, W. W. Winship, Ross C. Purdy.

Entered as second-class matter at the post office at Easton, Pa., under the act of March 3, 1879. Published monthly.
Subscription $1.50 a year. Single numbers twenty-five cents.
(*Foreign and Canadian postage, 50¢ additional on subscriptions*)

(*Copyright 1938, American Ceramic Society, Inc.*)

Lusterlite enamels

Few, if any, frit manufacturers have enjoyed such a high percentage of unsolicited repeat-orders as "Chicago Vit". And nothing evidences so clearly both quality and service as automatic repeat orders. You, too, can depend on LUSTERLITE ENAMELS.

CHICAGO VITREOUS ENAMEL PRODUCT COMPANY
1411 SOUTH 55th COURT
CICERO • ILLINOIS

SOLVAY
TRADE MARK REG. U. S. PAT. OFF.

dustless dense
SODA ASH

Made Especially for the Glass Maker

Specify SOLVAY when you buy Soda Ash because Solvay is and has been the standard of quality since 1881. It offers the following advantages:

1. More than 99.50% Sodium Carbonate (dry basis).
2. Proper granulation and absolute uniformity in quality.
3. Your choice of Soda Ash graded for efficient use with any of the known commercial glass sand.
4. The services of a well organized technical staff which is available to Solvay customers.

Make Solvay your source of supply for
DUSTLESS CALCINED 98-100%
POTASSIUM CARBONATE
Hydrated 83-85% Potassium Carbonate
Ground Caustic Potash

Full information sent on request.
SOLVAY SALES CORPORATION
Alkalies and Chemical Products Manufactured by The Solvay Process Company
40 RECTOR ST. NEW YORK

FLINT

PAPER MAKERS IMPORTING CO. INC. EASTON, PENNSYLVANIA U.S.A.

FINEST POTTERY CLAYS

TALC WHITING

Lancaster

INDUSTRY looks to SCIENCE for a solution of its problems.

The "Lancaster" Counter-Current Rapid Batch Mixing System is scientific. It definitely charts the course the ingredients of a batch must follow until uniformly and completely blended. It has been developed from data obtained after several years of intensive scientific research into diversified mixing processes.

◆

The intensity with which a mixing process is carried out depends on the movements of the individual particles relative to each other. The greater and more varied these relative movements are, and the greater the distance they have to travel in the batch without "free fall," the greater is the surface area which they have exposed to one another.

The "Lancaster" Scientific Mixing System embodies all the principles necessary to accomplish this desired result.

The "Lancaster" Mixer in full mixing action. Note the strongly vibrating life of the batch occasioned by its ever-changing activity—turning, dividing and dispersing the particles without "free fall."

◆

Learn all you can about your product . . . take an active interest in your Trade Association

LANCASTER IRON WORKS, INC.
BRICK MACHINERY DIVISION
LANCASTER, PENNA., U. S. A.

Lancaster

A compulsory movement of all particles against one another is provided in "Lancaster" Mixers, imparting to the batch uniform distribution through kneading, coating, and mulling action.

The "Lancaster" Mixer discharging the mixed batch. Note how the plows of the mixing star equipment deliver the mixed material to the discharge opening.

◆

"Lancaster" Mixers have now definitely proved their value in the Abrasive—Ceramic—Refractory—Glass—Vitreous Enamel—Welding Rod Coating—Chemical—Battery—and many other diversified industries.

Many large Universities and leading Research Laboratories have adopted the "Lancaster" Mixing System for developing formulas.

◆

LANCASTER IRON WORKS, INC.
BRICK MACHINERY DIVISION
LANCASTER, PENNA., U. S. A.

Lancaster

"Lancaster" Mixers

economize in the use of expensive raw materials,

in power, and in maintenance.

◆

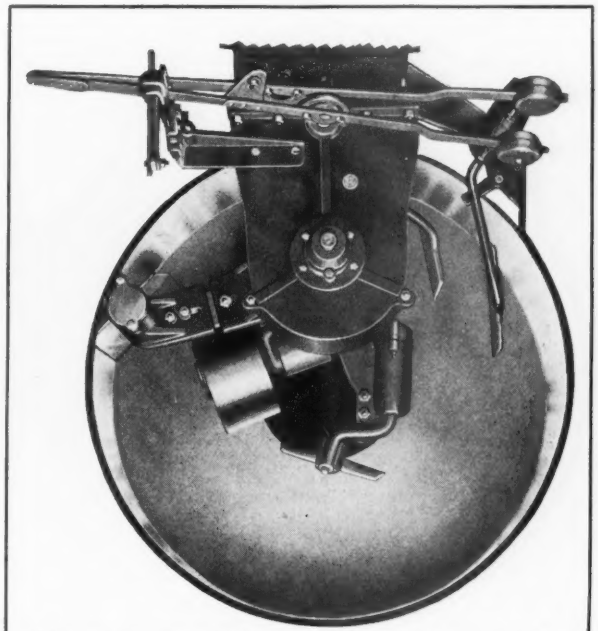
The size and physical characteristics of the grains are not broken, crushed, or otherwise changed.

Rich or lean spots are avoided. Every particle of the batch is definitely delivered into the mixing area.

No mechanical heat is developed during the mixing process.

Easiest possible cleaning facilities are provided and contamination between color batches avoided.

Difficult mixing problems are solved.



The "Lancaster" Mixer completely discharged of its mixed batch. Note the clean pan after each discharge, avoiding contamination with the next batch.

◆

LANCASTER IRON WORKS, INC.
BRICK MACHINERY DIVISION
LANCASTER, PENNA., U. S. A.

ALPHABETICAL LIST OF ADVERTISERS

	Page
American Potash & Chemical Corporation	21
American Telephone & Telegraph Co	26
Bausch & Lomb Optical Co	13
Bethlehem Steel Company	21
Buyers' Guide	9–12
Celo Mines, Inc	367
Ceramic Color & Chemical Mfg. Company	18
Chicago Vitreous Enamel Product Company	2
Corhart Refractories Company	16
DeVilbiss Mfg. Co	23
Drakenfeld, B. F., & Co	Inside Front Cover
Du Pont de Nemours, E. I., & Company	15
Edward Orton, Jr., Ceramic Foundation	18
Frazier-Simplex, Inc	17
Hammill & Gillespie, Inc	22
Harshaw Chemical Co	25
Hartford-Empire Company	6
Hommel, O., Company	22
Kentucky Clay Mining Co	20
Lancaster Iron Works, Inc	3–4–5
Louthan Mfg. Co	8
McDanel Refractory Porcelain Company	20
Metakloth Company	6
Metal & Thermit Corporation	Outside Back Cover
Norton Co	14
Orton, Edward, Jr., Ceramic Foundation	18
Pacific Coast Borax Company	20
Paper Makers Importing Company	2
Pennsylvania Salt Mfg. Co	7
Porcelain Enamel & Mfg. Company	19
Potters Supply Company	22
Professional Directory	19
Proctor & Schwartz, Inc	19
Ransome Concrete Machinery Co	19
Solvay Sales Corporation	2
Spinks, H. C., Clay Company	Inside Back Cover
Swindell-Dressler Corp	20
Vitro Mfg. Company	21
Willson Products, Inc	18
Wilson, H. W., Company	19
Wyodak Chemical Co	21

HARTFORD-EMPIRE COMPANY
HARTFORD, CONN.

Engineers and Licensors

FEEDERS FORMING MACHINES CONVEYORS
STACKERS LEHRS

FOR CLAY FILTRATION
use
METAKLOTH
(green)
Silvakloth
(black)

The oldest and best cupra-ammonium finishes for

POTTERY FILTER FABRICS.

These finishes give the fabric a smooth, lustrous, metallic surface—no fibres to catch and break the clay cake as it comes away in one perfect piece—filters better and faster than untreated cloths—requires fewer washings and is easier to keep clean—more continuous operation of your press—lower labor costs and a larger and better product with the same machinery.

The fabric is mildew proofed—has an increased tensile strength—has a longer useful life.

This means larger profits for you.

Consult your bag manufacturer or write to,

Metakloth Company, Lodi, N. J.

Kryolith
NATURAL GREENLAND CRYOLITE

For almost every manufacturing process, there is one product that is outstanding in its field. Usually it is a costly product. That is why the resourcefulness of American industry is so often directed toward the creation of new materials drawn from more economical sources of supply.

But sometimes the outstanding product is also the most economical, either costing less or providing substantial economies in the processes in which it is used. When that is the case, its universal use depends only on the time required for manufacturers to assure themselves of the facts.

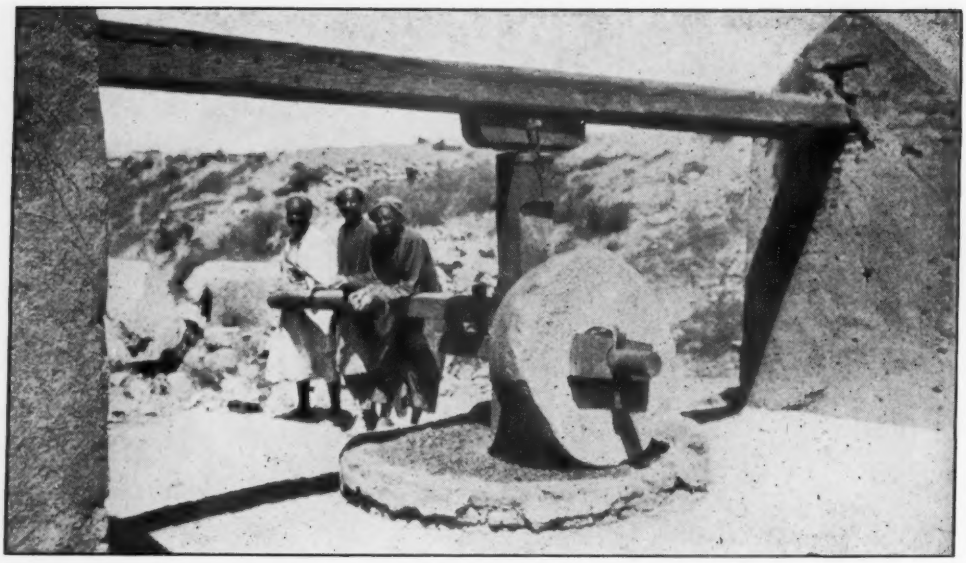
The fluoride flux and opacifier, Kryolith, is a product such as this. It is the genuine natural Greenland Cryolite, for which no adequate substitute has ever been found. Not only does it make better enamels possible, but it cuts costs by assuring greater uniformity and reducing rejects.

For improved products at lower cost, be sure the frit you buy is made with Kryolith — the only natural Greenland Cryolite imported, refined, and sold in North America.

TRADE MARK

PENNSYLVANIA SALT MANUFACTURING COMPANY · EST. 1850
WIDENER BLDG., PHILADELPHIA, PA.
New York · Chicago · St. Louis · Pittsburgh · Tacoma · Wyandotte

PENNSYLVANIA SALT *Chemicals*



TABLEWARE SETTERS

Eliminate warped ware in kiln and green room. Increase kiln production.

KIROX THIMBLES

Non-deteriorating. Resistant to thermal shock. High insulating value. No spitting.

FIRING RACKS

For glost kilns. More ware and better. Less fuel—less storage. Dispenses with saggers.

TILE SETTER PINS

Of Kirox. Straight and true. Defy deflection. No spitting to mar ware.

TRENDS

LOUTHAN has created many new ways for the ceramic plant to minimize operating costs, reduce production losses, dispense with waste . . . all through the development of really satisfactory high-fire refractory bodies.

Striking examples of this modern trend in perfection are LOUTHAN Hi-Fire Setters for dinnerware . . . Kirox Tile Setter Pins . . . LOUTHAN Firing Racks . . . Hi-Fire Thimbles, etc.

The new brochure "Kiln Room Requisites" gives complete data on all standard items in the LOUTHAN line. It's yours for the asking. LOUTHAN service also includes design and manufacture of all kinds of special refractory parts, such as props, special setters, racks, shelving, etc. Inquiries invited.

DINNERWARE SETTERS
TILE SETTER PINS
DECORATING THIMBLES
FIRING RACKS
PINS, STILTS, SPURS, PROPS, etc.

LOUTHAN
REFRACTORIES
The LOUTHAN MANUFACTURING COMPANY
Ceramic Specialists
EAST LIVERPOOL, OHIO, U. S. A.

Abrasives
Carborundum Co. (*Carborundum and Aloxite*)
Celo Mines, Inc. (*Almanite Garnet*)
Chicago Vitreous Enamel Products Co.
The Hommel Co., O., Inc.
Norton Co. (*Alundum-Crystolon*)

Air Conditioning Systems
Frazier-Simplex, Inc.

Aloxite (Refractory Products)
Carborundum Co.

Alumina (Hydrate and Calcined)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Alumina (Fused) Brick and Tile
Electro Refractories & Alloys Corp.
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.

Aluminum Oxide (Calcine)
The Hommel Co., O., Inc.
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.

Aluminum Oxide (Fused)
Carborundum Co.
Electro Refractories & Alloys Corp.
Harshaw Chemical Co.
Norton Co.
The Vitro Mfg. Co.

Alundum (Refractory Products)
Norton Co.

Ammonium Bicarbonate
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Solvay Sales Corp.

Ammonium Bifluoride
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Ammonium Carbonate
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Antimony Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Antimony Sulphide
Foote Mineral Co.
The Hommel Co., O., Inc.

Arches (Interlocking, Suspending, and Circular)
Frazier-Simplex, Inc.

Arsenic
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Automatic Brick Car Loaders
Lancaster Iron Works, Inc.

Ball Mills
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Hardinge Company, Inc.
The Hommel Co., O., Inc.
McDanel Refractory Porcelain Co.
The Vitro Mfg. Co.

Ball Mills (Laboratory Type)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Denver Fire Clay Co.
Hardinge Company, Inc.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Barium Carbonate
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Batch Systems
Frazier-Simplex, Inc
Lancaster Iron Works, Inc.

Batts
Carborundum Co. (*"Carbofrax Aloxite"*)
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co. (*Alundum-Crystolon*)

Benders (Bar)
Ransome Concrete Machinery Co.

Beryl
Foote Mineral Co.

Bichromate of Soda
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Bitstone
Potters Supply Co.

Blocks (Refractory)
Carborundum Co.
Chicago Vitreous Enamel Product Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Louthan Mfg. Co.
Norton Co.
The Vitro Mfg. Co.

Body Stains
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.

Bone Ash
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Borax
American Potash & Chemical Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pacific Coast Borax Co.
The Vitro Mfg. Co.

Borax Glass
American Potash and Chemical Corp.
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pacific Coast Borax Co.
The Vitro Mfg. Co.

Boric Acid (Anhydrous)
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pacific Coast Borax Co.
The Vitro Mfg. Co.

Boric Acid (Crystal, Granular, or Powder)
American Potash & Chemical Corp.
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pacific Coast Borax Co.
The Vitro Mfg. Co.

Boron Carbide
Norton Co.

Brick Machines (also Barrows, Molds)
Lancaster Iron Works, Inc.

Brick (Refractory)
Carborundum Co. (*"Carbofrax Aloxite"*)
Chicago Vitreous Enamel Product Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.
The Vitro Mfg. Co.

Buckets (Concrete, Elevator)
Ransome Concrete Machinery Co.

Cadmium Sulphide
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Carbofrax (Refractory Products)
Carborundum Co.

Carbonates (Barium, Lead)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Castings
Lancaster Iron Works, Inc.

Castings (Abrasive Resisting)
Bethlehem Steel Co.

Caustic Potash
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Solvay Sales Corp.

Caustic Soda
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
The Vitro Mfg. Co.

Cements
Carborundum Co.
Chicago Vitreous Enamel Product Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Pennsylvania Salt Mfg. Co.

Ceramic Chemicals
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
Pennsylvania Salt Mfg. Co.
The Porcelain Enamel and Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Cerium Oxide
Foote Mineral Co.

Chromite (Natural Chromate of Iron)
Foote Mineral Co.

Chromium Oxide
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Clay (Ball)
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Kentucky Clay Mining Co.
Paper Makers Importing Co.
Potters Supply Co.
Spinks, H. C., Clay Co.
The Vitro Mfg. Co.
United Clay Mines Corp.

Clay (Block)
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Clay (China)
Ceramic Color & Chemical Mfg. Co.
Edgar Brothers Co.
Edgar Plastic Kaolin Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Vitro Mfg. Co.
United Clay Mines Corp.

Clay—Cleaners, Feeders
Lancaster Iron Works, Inc.

Clay (Electrical, Porcelain)
Ceramic Color & Chemical Mfg. Co.
Edgar Brothers Co.
Edgar Plastic Kaolin Co.
Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.
Kentucky Clay Mining Co.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
United Clay Mines Corp.

Clay (Enamel)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Edgar Brothers Co.
Edgar Plastic Kaolin Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Kentucky Clay Mining Co.
Metal & Thermit Corp.
Paper Makers Importing Co.
The Porcelain Enamel & Mfg Co.
Spinks, H. C., Clay Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.
United Clay Mines Corp.

Clay (Fire)
Denver Fire Clay Co.
Edgar Brothers Co.

Edgar Plastic Kaolin Co.
Paper Makers Importing Co.
Potters Supply Co.

Clay (German Vallendar)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Kentucky Clay Mining Co.
The Porcelain Enamel & Mfg. Co.
The Vitro Mfg. Co.
United Clay Mines Corp.

Clay Miners
Edgar Brothers Co.
Edgar Plastic Kaolin Co.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
United Clay Mines Corp.

Clay (Potters)
Denver Fire Clay Co.
Edgar Brothers Co.
Edgar Plastic Kaolin Co.
Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.
Kentucky Clay Mining Co.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
United Clay Mines Corp.

Clay (Process Equipment)
Hardinge Company, Inc.
Lancaster Iron Works, Inc.

Clay (Sagger)
Edgar Brothers Co.
Edgar Plastic Kaolin Co.
The Hommel Co., O., Inc.
Kentucky Clay Mining Co.
Paper Makers Importing Co.
Potters Supply Co.
Spinks, H. C., Clay Co.
United Clay Mines Corp.

Clay (Wad)
Kentucky Clay Mining Co.
Potters Supply Co.
Spinks, H. C., Clay Co.
United Clay Mines Corp.

Clay (Wall Tile)
Edgar Brothers Co.
Edgar Plastic Kaolin Co.
Hammill & Gillespie, Inc.
Kentucky Clay Mining Co.
Paper Makers Importing Co.
Spinks H. C., Clay Co.
United Clay Mines Corp.

Cleaners
Pennsylvania Salt Mfg. Co.
The Porcelain Enamel and Mfg. Co.

Cleaners, Chemical
Harshaw Chemical Co.
Pennsylvania Salt Mfg. Co.

Clocks (Gauge Board)
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.

Cobalt Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.,
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O. Inc.
The Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Cobalt Sulphate
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Colors
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Concrete (Chutes, Grouters)
Ransome Concrete Machinery Co.

Cones
The Edward Orton, Jr., Ceramic Foundation

Conveying Equipment
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.

Copper Oxide
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Corhart
Corhart Refractories Co.

Cornwall Stone (Imported)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.

Crucibles (Filter, Melting, Ignition)
Carborundum Co.
Denver Fire Clay Co.
Norton Co.
Potters Supply Co.

Crushers (Clay)
Lancaster Iron Works, Inc.

Cryolite (see Kryolith)
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.

Crystolon (Refractory Products)
Norton Co.

Cullet, Washing Plants, Incinerators, Crushers
Frazier-Simplex, Inc.

Cutters (Bar)
Ransome Concrete Machinery Co.

Decorating Supplies
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Disintegrators
Hardinge Company, Inc.
Lancaster Iron Works, Inc.

Dryer (Pipe Rack)
Lancaster Iron Works, Inc.

Drying Machinery
Frazier-Simplex, Inc.
Hardinge Company, Inc.
Lancaster Iron Works, Inc.
Proctor & Schwartz, Inc.

Electrocast Refractories
Corhart Refractories Co.

Enameling Equipment (Complete)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Frazier-Simplex, Inc.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Enameling Furnaces
Carborundum Co.
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Electro Refractories & Alloys Corp.
The Hommel Co., O., Inc.
Lancaster Iron Works, Inc.
Norton Co.

Enameling Iron (Sheet)
American Rolling Mill Co.
Bethlehem Steel Co.

Enameling Muffles
Bethlehem Steel Co.
Carborundum Co. (*Carbofrax*)
Chicago Vitreous Enamel Product Co.
Electro Refractories & Alloys Corp.
Frazier-Simplex, Inc.
Norton Co. (*Alundum*)

Enameling (Practical Service)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Enamel Oxide
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Enamels (Porcelain)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Equipment (Porcelain Enameling)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The DeVilbiss Co.
Hardinge Company, Inc.
The Hommel Co., O., Inc.

Exhaust Systems
The DeVilbiss Co.

Feldspar
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Fire Brick
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co
Electro Refractories & Alloys Corp.
Norton Co.

Fire Brick—Process Equipment
Lancaster Iron Works, Inc.

Fire Clay
Denver Fire Clay Co.
Spinks, H. C., Clay Co.

Flint
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Porcelain Enamel and Mfg. Co.

Flint Pebbles
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Floors (Non-Slip)
Norton Co.

Fluorspar
Harshaw Chemical Co.
The Hommel Co., O., Inc.

French Flint
Paper Makers Importing Co.

Frit
Allied Engineering Co.
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Frosting Mixtures
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Fuel Oil Systems and Control, Stokers
Bethlehem Steel Co.
Frazier-Simplex, Inc.

Furnaces
Allied Engineering Co.
Carborundum Co. (*Carboradiant*)
Chicago Vitreous Enamel Product Co.
Denver Fire Clay Co.
Frazier-Simplex, Inc.
The Hommel Co., O., Inc.
Swindell-Dressler Corp.

Furnaces-Enameling
Swindell-Dressler Corp.

Glass Bending Ovens, Glass Decorating Machines
Frazier-Simplex, Inc.

Glass Equipment
Hartford-Empire Co.
Lancaster Iron Works, Inc.

Glass Melting Tanks and Furnaces
Frazier-Simplex, Inc.

Glass Thickness Gauge
Bausch & Lomb Optical Co.

Glaze and Body Spar
Ceramic Color & Chemical Mfg. Co
Du Pont de Nemours, E. I., & Co. Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Glazes and Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Glaze Spar
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.

Goggles
Cover, H. S.
The Hommel Co., O., Inc.
Willson Products, Inc.

Gold
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. H. & Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Gold Decorations
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.

Granulators
Hardinge Company, Inc.
Lancaster Iron Works, Inc.

Grinding Wheels
Carborundum Co. (*Carborundum and Aloxite*)
Chicago Vitreous Enamel Product Co.
Norton Co. (*Alundum-Crystolon*)

Hearths
Carborundum Co. (*Carbofrax* heat treating)
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co. (*Crystolon*)

Hearths (Fused Al_2O_3, SiC)
Electro Refractories & Alloys Corp.

Hearths (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Norton Co.

Hoppers (Floor, Tower)
Ransome Concrete Machinery Co.

Hose (Air and Fluid)
The DeVilbiss Co.

Hydrofluoric Acid
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Iron Chromite
Harshaw Chemical Co.

Iron (Enameling)
American Rolling Mill Co
Bethlehem Steel Co.

Iron Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Kaolin
Ceramic Color & Chemical Mfg. Co.
Edgar Brothers Co.
Edgar Plastic Kaolin Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
United Clay Mines Corp.
The Vitro Mfg. Co.

Kellog AA Refractories
Electro Refractories & Alloys Corp.

Kilns, China (Decorating)
Allied Engineering Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Frazier-Simplex, Inc.
The Hommel Co., O., Inc.
Swindell-Dressler Corp.

Kilns-(Electric, Circular, Tunnel)
Allied Engineering Co.
Swindell-Dressler Corp.

Kiln Furniture (Silicon Carbide, Semi-Silicon Carbide) (Refractory)
Electro Refractories & Alloys Corp.
Louthan Mfg. Co.

Kyanite
Celo Mines, Inc.

Kryolith (See Cryolite)
Pennsylvania Salt Mfg. Co.

Laboratory Ware
Norton Co.

Lehr Tile (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Electro Refractories & Alloys Corp.

Lehrs
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehrs (Electric or Fuel Heated)
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehr Loaders
Frazier-Simplex, Inc.

Linings (Furnace Refractory, Block Refractory Plate, Brick and Tile)
Carborundum Co.
Chicago Vitreous Enamel Product Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.
The Vitro Mfg. Co.

Lithium Carbonate
Foote Mineral Co.

Lithium Minerals
Foote Mineral Co.

Magnesia (Fused)
Electro Refractories & Alloys Corp.
Norton Co.

Magnesia (Sintered, Calcined)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Porcelain Enamel and Mfg. Co.

Magnesite
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Magnesite Calcined
Foote-Mineral Co.
The Hommel Co., O., Inc.

Magnesium Carbonate
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Manganese
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Manganese Dioxide
Foote Mineral Co.

Manganese (Oxide)
Ceramic Color & Chemical Mfg. Co.
Corhart Refractories Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Masks (Breathing)
The DeVilbiss Co.
Willson Products, Inc.

Metals (Porcelain Enameling)
American Rolling Mill Co.
Bethlehem Steel Co.

Microscopes (Polarizing)
Bausch & Lomb Optical Co.

Minerals
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Mixers
Ransome Concrete Machinery Co.

Mixers (Batch)
Lancaster Iron Works, Inc

Mixers (Concrete, Paving, Road Paving, Plaster, Asphalt, Truck, Mortar, Bituminous)
Ransome Concrete Machinery Co.

Mold Sanders
Lancaster Iron Works, Inc.

Muffles (Furnace)
Allied Engineering Co.
Carborundum Co. (*Carbofrax*)
Chicago Vitreous Enamel Product Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Frazier-Simplex, Inc.
Norton Co.

Muffles (Laboratory)
Electro Refractories & Alloys Corp.

Mullite (Refractories)
Electro Refractories & Alloys Corp.

Muriatic Acid
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pennsylvania Salt Mfg. Co.

Needle Antimony
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Nickel Salts
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Nitrates (Cobalt, Sodium)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Nitre
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Non-Gro Refractories
Electro Refractories & Alloys Corp.

Norbide (Norton Boron Carbide)
Norton Co.

Olivine
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Opacifiers
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Overglaze Colors
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Oxides
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Palladium Decorations
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.

Pins
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.
Louthan Mfg. Co.
Potters Supply Co.

Pins (Tile Setter)
Louthan Mfg. Co.

Placers (Concrete Pneumatic)
Ransome Concrete Machinery Co.

Platinum Decorations
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.

Polariscopes
Bausch & Lomb Optical Co.
Frazier-Simplex, Inc.

Porcelain Enameling Service (Practical)
American Rolling Mill Co.
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Hardinge Company, Inc.
The Hommel Co., O., Inc.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Porcelain Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Potters Wheels
Denver Fire Clay Co.

Potash (Carbonate)
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc. R. & H. Chemicals Dept.
Harshaw Chemical Co.

The Hommel Co., O., Inc.
Solvay Sales Corp.
The Vitro Mfg. Co.

Producer Glass Plants
Frazier-Simplex, Inc.

Pug Mills
Lancaster Iron Works, Inc.

Pyrites (Natural Iron Sulphide)
Foote Mineral Co.
The Hommel Co., O., Inc.

Pyrometer Tubes
Carborundum Co.
Electro Refractories & Alloys Corp.
Montgomery Porcelain Products Co.

Pyrometer Tubes (Refractory and Hard Porcelain)
Denver Fire Clay Co.
McDanel Refractory Porcelain Co.
Norton Co.

Pyrometers (Optical, Radiation, Surface, Immersion, Needle)
Pyrometer Instrument Co.

Pyrometric Cones
The Edward Orton, Jr., Ceramic Foundation

Racks, Firing (Refractory)
Louthan Mfg. Co.

Raw Material Handling Equipment
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.

Refractometers
Bausch & Lomb Optical Co.

Refractories
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Louthan Mfg. Co.
Norton Co.

Refractory Materials
Carborundum Co.
Chicago Vitreous Enamel Product Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Louthan Mfg. Co.
Norton Co.
Titanium Alloy Mfg. Co.

Represses (Automatic)
Lancaster Iron Works, Inc.

Respirators
Chicago Vitreous Enamel Product Co.
Cover, H. S.
The DeVilbiss Co.
The Hommel Co., O., Inc.
Willson Products, Inc.

Rutile
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Saggers
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.
Potters Supply Co.

Salt Cake
American Potash & Chemical Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pennsylvania Salt Mfg. Co.

Sandblast Helmets
Willson Products, Inc.

Sand Grinder and Sifters
Lancaster Iron Works, Inc.

Saponin
The Hommel Co., O., Inc.

Selenite of Sodium
Drakenfeld, B. F., & Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Selenium
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Setters (Tableware)
Louthan Mfg. Co.

Sheaves (Tower)
Ransome Concrete Machinery Co.

Sheets (Enameling Iron)
American Rolling Mill Co.
Bethlehem Steel Co.

Silica (Fused)
Electro Refractories & Alloys Corp.
The Hommel Co., O., Inc.

Silicate of Soda
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
The Hommel Co., O., Inc.
Harshaw Chemical Co.

Silicon Carbide
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Silicon Carbide Firesand
Carborundum Co.

Sillimanite Refractories
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.

Slabs (Furnace)
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Soda Ash
American Potash and Chemical Corp.
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
The Vitro Mfg. Co.

Sodium Antimonate
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Sodium Fluoride
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Sodium Metasilicate
Harshaw Chemical Co.

Sodium Nitrite
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Sodium Silica Fluoride
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Sodium Uranate
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Soot Blowers
Frazier-Simplex, Inc.

Special Machines
Frazier-Simplex, Inc.

Spar
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Vitro Mfg. Co.

Spray Booths
The DeVilbiss Co.
The Hommel Co., O., Inc.

Spraying Equipment
The DeVilbiss Co.
The Hommel Co., O., Inc.

Spurs
Louthan Mfg. Co.
Potters Supply Co.

Stacks
Lancaster Iron Works, Inc.

Steel Plate Construction
Bethlehem Steel Co.
Lancaster Iron Works, Inc.

Stilts
The Hommel Co., O., Inc.
Louthan Mfg. Co.
Potters Supply Co.

Sulfuric Acid
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pennsylvania Salt Mfg. Co.

Talc
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.

Tanks
Frazier-Simplex, Inc.

Tank Blocks
Corhart Refractories Co.

Tanks (Pickle)
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.

Tanks for Raw Material Steel or Concrete
Bethlehem Steel Co.
Lancaster Iron Works, Inc.

Tile (Floor)
Norton Co.

Tile (Muffle)
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Tile Setter Pins
Louthan Mfg. Co.

Tile (Refractory)
Carborundum Co. (*Carbofrax*)
Chicago Vitreous Enamel Product Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.

Tile (Wall)
Denver Fire Clay Co.

Tin Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Titanium
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Titanium Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Towers (Concrete, Concrete Elevating, Steel Elevating)
Ransome Concrete Machinery Co.

Tri Sodium Phosphate
Harshaw Chemical Co.

Trucks
Lancaster Iron Works, Inc.

Tubes (Insulating)
Carborundum Co.
Louthan Mfg. Co.
McDanel Refractory Porcelain Co.
Norton Co.

Tubes (Pyrometer)
Carborundum Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
McDanel Refractory Porcelain Co.
Norton Co.

Uranium Oxide
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Uranium Oxide (Yellow-Orange-Black)
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Water Softening Plants
Frazier-Simplex, Inc.

Wet Enamel
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Whiting
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Vitro Mfg. Co.

Winding Drums
Lancaster Iron Works, Inc.

Zinc Oxide
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Zircon
Foote Mineral Co.
The Hommel Co., O., Inc.

Zirconia
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Zirconium Oxide
Foote Mineral Co.
The Hommel Co., O., Inc.

Zirkite (Natural ZrO_2)
Foote Mineral Co.

OFFICIAL AMERICAN CERAMIC SOCIETY EMBLEM

10 K. Solid Gold—$6.50
20 Year Gold Filled—$3.25

Order directly from the

AMERICAN CERAMIC SOCIETY
2525 N. High St., Columbus, Ohio

Be sure to enclose check or money order for full amount

Advertise in The Bulletin

Number of Insertions

	1 month	*3 months*	*6 months*	*12 months*
Full page	$66.00	$60.00	$52.00	$44.00
Half page	36.00	33.00	30.00	26.00
Quarter page	20.00	18.00	16.50	15.00
Eighth page	10.75	9.90	9.00	8.25

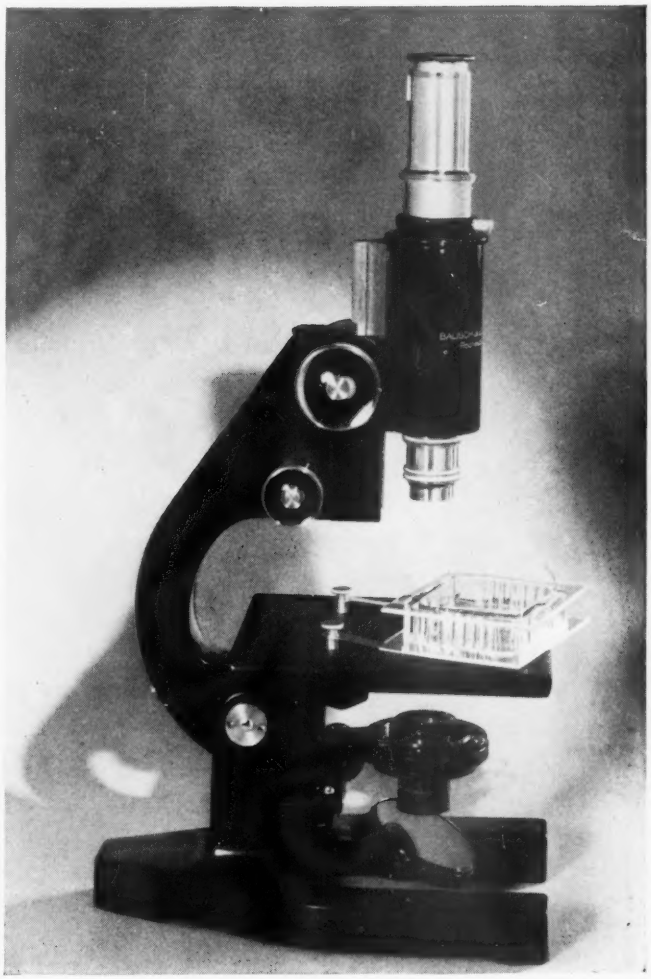
Classified advertisements: 35 words for $1.10 per insertion

Cover positions: list plus 25%

First page preceding or following reading matter: list plus 20%

Color rates: on application

Reading notices not accepted



B&L RING TEST MICROSCOPE
TO COMPLETE YOUR INSPECTION PROCESSES

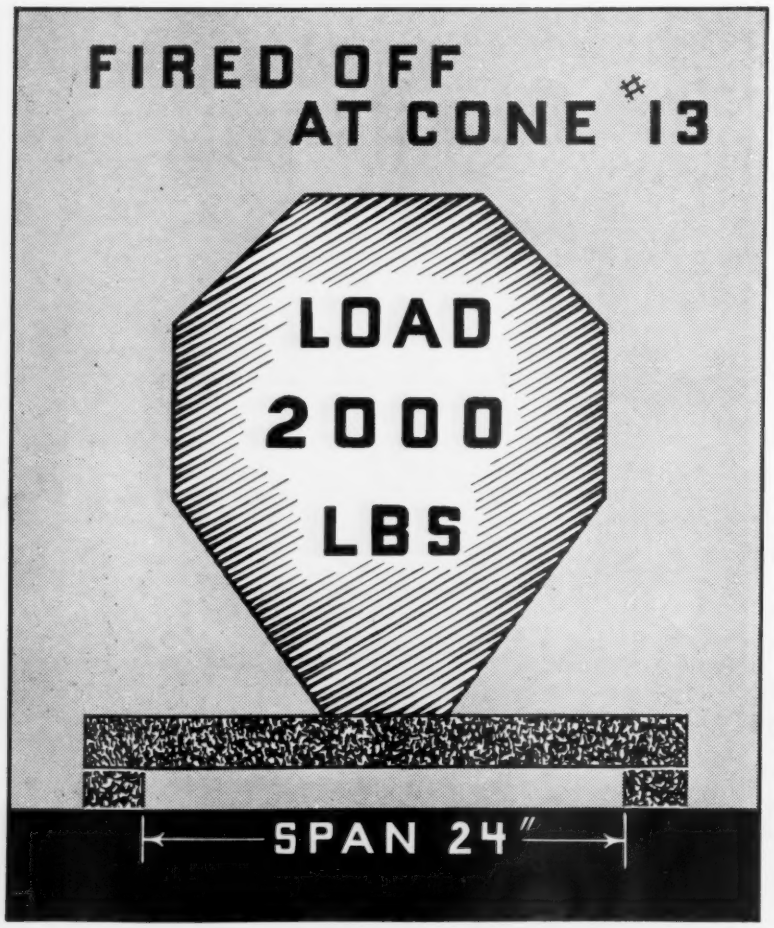
Many glass manufacturers depend upon a B & L Ring Test Microscope as a means of increasing the value of inspection. "Cordy" conditions, often a source of trouble, that do not show up under routine Polariscope examination, are clearly revealed under the Ring Test Microscope. Sections up to one inch in height may be examined under the B & L Ring Test Microscope which is specially constructed and fitted for this type of work. Through the addition of available accessories it may also be used for many other purposes in the glass plant.

Write for complete details to Bausch & Lomb Optical Co., 654 St. Paul Street, Rochester, New York.

BAUSCH & LOMB

.... WE MAKE OUR OWN GLASS TO INSURE STANDARDIZED PRODUCTION

FOR YOUR GLASSES INSIST ON B & L ORTHOGON LENSES AND B & L FRAMES...



At Cone No. 13

One Ton Load . . .

CRYSTOLON KILN FURNITURE

IN the plant of a large manufacturer of ceramic products, Crystolon Batts are showing no deformation after carrying a load of 2000 pounds at Cone No. 13.

The batts are 30 x 24 x 2½" and the clear span as set is 24". The product is so shaped that the load is concentrated in the center of the span and imposes a stress of about 200 pounds per square inch.

It is because of their exceptional strength—and the long life and durability accompanying it—that Crystolon Batts are so effectively cutting kiln furniture costs. It will pay you to use this Norton silicon carbide product.

NORTON COMPANY
Worcester, Mass.
New York, Chicago, Cleveland

NORTON

NORTON
REFRACTORIES

Presenting

du Pont BLACK 4490

A NEW LOW-COST HIGH QUALITY BLACK OXIDE FOR ENAMELING CAST IRON, SHEET STEEL AND GRAINING

THIS new dense black is equal, and for many purposes decidedly superior, to the blacks now being used. With black edge frits, Black 4490 reduces the tendency to blister on refiring. In graining with Black 4490, there is little or no "sinking in." When the less expensive clear ground frits are used, excellent blacks are obtained, making the new black even more economical for the enameler.

This new black oxide was developed by du Pont ceramic research to meet the modern requirements of the enameling industries for high quality products. Black 4490 is economical in use and can be depended on to produce required results over a wide range of operating conditions.

For information, samples, prices about du Pont Black 4490 and other ceramic products, call or write to our nearest district office.

DU PONT
REG. U.S. PAT. OFF.

The R. & H. Chemicals Department
E. I. DU PONT DE NEMOURS & COMPANY, INC.
Wilmington, Delaware

District Sales Offices: Baltimore, Boston, Charlotte, Chicago, Cleveland, Kansas City, Newark, New York, Philadelphia, Pittsburgh, San Francisco

A COMMON DENOMINATOR FOR TANK COMPARISONS!

BECAUSE no two glass-melting operations are exactly alike, it is often very difficult to make exact and clear-cut comparisons between different furnaces and different furnace materials.

In casting about for some definite yardstick, we have for several years been studying the relations between various tanks, by reducing their outputs to the *number of tons produced per life, per square foot of melting area.* By this method, the engineer can often arrive at some fairly accurate comparisons which would otherwise defy analysis.

Applying this yardstick to all more or less complete Corhart furnaces on which we have records, we get a result of 61.8 tons per square foot of melting area per life. These figures cover a ten year period. During the past three or four years, however, the technique of operation and the proper application of refractories have naturally shown marked improvement. We would expect this improvement to reflect itself in a higher production factor, and we are not disappointed: *The average of five recent Corhart furnaces shows 87.8 tons of glass per square foot per life—an increase of 42%.**

Our statistics gathered on non-Corhart furnaces over the past ten years show an average of 20.6 tons per square foot per life.* If we accept this figure and add 100% to allow for modern improvements in operating conditions and materials, we still find the non-Corhart tanks less than half as productive as the Corhart furnaces.

All of these figures represent average performances. We know of one furnace that contained Corhart only in the throat and doghouse, which produced 69 tons of clear flint glass per square foot during one life. But this, of course, is exceptional. Against that we can mention the exceptional figure of a Corhart furnace that went out last December after producing 117 tons per square foot during one life.

Compare your own results with these figures. We believe it will give you a very fair idea of the gain you could make, in life and production, by a fuller use of Corhart Electrocast. . . . Corhart Refractories Company, *Incorporated*, 16th and Lee Sts., Louisville, Ky. . . . *In Europe:* L'Electro Refractaire, Paris. *In Japan:* Asahi Glass Co., Tokio.

* All furnaces included in this compilation were melting clear flint glass for the production of container ware.

QUALITY ECONOMY ENDURANCE

CORHART ELECTROCAST REFRACTORIES

THE BULLETIN
OF THE AMERICAN CERAMIC SOCIETY

A Monthly Publication Devoted to Proceedings of the Society and Promotion of Coöperative Research of Technical, Scientific, and Art Questions

VOLUME 17 **SEPTEMBER, 1938** **NUMBER 9**

PAPERS

APPLICATION OF DRY MIXING IN THE WHITEWARE AND REFRACTORY INDUSTRIES*

By F. A. Fix

I. Introduction

Dry mixing is attracting increasing attention of the ceramic products manufacturers, and its merits, as applied to their various products, are being carefully investigated. The term, "dry mixing," refers to a process whereby presized ceramic materials are first uniformly blended in the dry state; then an exact amount of water is distributed uniformly throughout the batch. The amount of liquid used depends on the required state of plasticity for the product being manufactured. The finished mix must be true to formula to assure constant workability, whether the mix contains only a small percentage of moisture or is of soft or stiff plastic consistency.

Finely pulverized materials are required for satisfactory results. The requirement that the ceramic materials need to be air-floated depends on the type of ware being made; it is important, however, that the materials be free of visible specking particles to assure a clean product.

Proper control of dust during the mixing of the dry ingredients is essential. This dust represents part of the formula and should be confined in the mixing chamber. Means for controlling the dust while materials are being introduced into the dry mixing equipment should be provided. This has been accomplished (1) by using hoppers with vented openings operating on tramrails to handle the materials from storage to the mixing equipment, and (2) by elevating the materials into the mixing chamber by closed skip buckets.

The equipment needed to prepare the mixed material properly depends on the type of product manufactured. The mixing equipment itself is of the same type; but following the mixing operation, the body preparation must be taken care of by a dust mill for the drier consistencies or by a pug mill for the plastic consistencies.

The matter of specking in the finished ware because of metallic iron in one or more of the ingredients is a frequent point of discussion. Generally there have been no complaints of specking from manufacturers using the dry-mixing method.

The data and information given in this paper are based on a survey made by personal contact or by answers to questionnaires sent out to the ceramic products manufacturers who have adopted the dry-mixing method of preparation. This is a consensus, therefore, of the users' opinions as to the value of this method, as well as their comments on the matter of production and operating results.

II. Electrical Porcelain and Electrical Refractories

The electrical porcelain and electrical refractories industries were probably the first industries where dry mixing, in its present development, was used. Successful results were obtained, although at the beginning air-floated clays were not available. Proper supplementary preparation was

* Presented at the Fortieth Annual Meeting, American Ceramic Society, New Orleans, La., March 30, 1938 (Materials and Equipment Division). Received March 31, 1938.

necessary and extended mixing time was required. Because air-floated clays are now available, the operation is simplified.

The arrangement of equipment used for preparing the mixed materials can be listed generally as follows: (1) a batch wagon or a scale car for accumulating the batch materials from storage; weighing is reduced to a minimum if the ingredients are purchased in bags; it may even be possible to eliminate weighing altogether with some of the ingredients; (2) magnetic separation (if scrap is used); (3) dry-mixing equipment; (4) receiving hopper; (5) conveyer means for hopper to dust mill; (6) dust mill; and (7) means for transporting granules to press room, such as wood boxes on wheels or a similar conveyance.

The regular procedure is to introduce all the materials into the mixer. It has been found desirable to sandwich the plastic materials between the nonplastics. (Dry mix for a period up to three minutes; then add the water by spray and wet mix from three to six minutes.)

The mixed batch is discharged and passes onto the dust mill where the proper size granules are produced to suit the type and kind of ware being pressed.

Dry-pressed porcelain fixtures and accessories would be processed practically the same way except for a possible change in the formula.

(1) Extracts from Reports of Electrical Porcelain and Electrical Refractory Plants

Plant No. 1 has been operating dry-mixing equipment since June, 1937. The working procedure is as follows: (1) use of bagged ingredients; (2) operation on 8-minute mixing cycle; (3) use of two men who produce 3600 lb. dry-mixed material per hour (equal to 1800 lb. per man compared with 800 lb. per man per hour by the wet process); (4) reduction of power requirements from 86 to 17.8 h.p.; (5) 30% improvement in dry strength; fired strength improved 30%; absorption reduced 6%; (6) raw material cost increased 7%; consideration must be given to increased amount of clay per ton in air-floated condition and elimination of loss of clay through blunging; elimination of freight expense on water in lump clay; and (7) savings effected in cost of water.

Plant No. 2 has been operating dry-mixing equipment since January, 1936, with the following recorded data: (1) 50% savings in power; (2) fired strength equal to the wet processed body; (3) reduction of 10 to 15% in cost of body preparation; (4) accurate moisture control enables them to meet rigid specifications on mechanical strength and dimensional tolerance; allowable moisture variation is $^{2}/_{10}$ of 1% (they keep within this limit); (5) maintenance cost is low; (6) dust-tight cover essential to proper dust control; and (7) cost of operating dry-mixing equipment does not exceed cost of replacing filter sacks.

Plant No. 3, operating dry-mixing equipment since September, 1937, reports as follows: (1) 30% savings in labor; (2) elimination of large storage space (mixed materials go directly to presses from mixers); savings because of no investment in stored prepared materials; (3) accurate moisture control available and considered important; and (4) this plant suggests a larger selection of available clays in air-floated condition.

Plant No. 4, operating dry-mix process since October, 1937, reports as follows: (1) same number of men produce as much mixed material ready for pressing in 3 hours as by the wet process in 10 hours; (2) total mixing cycle is 8 minutes; (3) advises dry-mixing equipment to be efficient; (4) recommends use of bagged materials to avoid possible contamination from nails, shavings, etc., present in bulk shipments; and (5) moisture control is valuable; this plant uses an automatically operated water meter which controls the amount of water; meter shuts off when the predetermined amount of water flows through.

III. Floor and Wall Tile Bodies

Wall tile is being successfully made by the dry-mixing method and manufacturers claim the tile is of first quality. The setup of equipment is the same as for electrical porcelain production. The mixing procedure is the same, except for less moisture; accurate moisture control is necessary to obtain uniform shrinkage.

In the use of wetting agents, it is found that a low percentage added to the water is effective in obtaining moisture penetration in the ingredients without detrimental effects; the addition of $^{1}/_{10}$ of 1% makes the water as penetrable as alcohol.

Floor tile bodies have also been prepared by this method. The mixing time averages 6 to 8 minutes per cycle.

Careful consideration should be given to the body formula, because it was found in one instance that the substitution of one type of material for another resulted in giving the desired physical requirements and, at the same time, reduced the cost of the body.

(1) Extracts from Reports on Tile Operations

Plant No. 1 has operated dry-mixing equipment since February, 1937; the following report is given: (1) production of 3000 pounds of dry mixed material per hour with less than 15 h.p.; (2) mixed materials, conveyed by belt to dust mill, are discharged directly into top of storage bins from mill; (3) no specking in ware; (4) this is an old plant and, instead of rehabilitating the old wet-process equipment, a small room was utilized in which the dry mixer was installed; the installation ready for operation was made in a few days; no expensive pits and pipe lines required; complete setup of dry-mixing equipment is a simple and efficient arrangement; and (5) the product

being made meets all mechanical and physical requirements.

IV. Chemical Stoneware

The work done so far in this field shows promising results. The dry mixing of presized materials is practical, and results show an improvement in the structural qualities over the wet process.

The dry strength of the body was increased about 30%, and the absorption was approximately 1½% less. The fired strength was 5% greater with the dry-mixed bodies.

Higher dry strength offers a definite advantage because it increases the safety with which large tanks can be handled from the drying rooms to the kilns. This increased strength also makes it easier to handle the units.

The dry-mixing operation can be performed with an 8-minute cycle.

In regular process it is contemplated to add only 50% of the water; the remainder of the water is added at the pug mill, depending on the consistency required for the particular type of ware being produced.

The materials used are finely pulverized but are not air-floated. Iron spots are reported to be less prevalent than in ware made by the wet process.

V. Vitreous and Semivitreous China

Both types of chinaware bodies have been prepared by the dry-mixing method with encouraging results. It is apparent from these results that dry-mixed processed ware is equal to regular body ware in eye appeal as well as mechanical and physical requirements.

Recent tests indicate that dry-mixed bodies show a modulus of rupture reading of 657 lb. per sq. in. as compared to 660 lb. per sq. in. in the regular body.

It is recommended that dry-mixed bodies be put through a vacuum pug mill. The proper percentage of absorption can be obtained by adjusting the body formula.

The important point is that the dry-mixed body stands up well in comparison with the regular body. Autoclave tests of the dry-mixed product showed no indication of crazing after three hours at a 100-pound steam pressure.

Ease of workability of the dry-mixed body is another favorable result of dry mixing. It is uniform in moisture distribution, assuring uniform shrinkage. The results show that the plates were jiggered with ease and were straight in the clay state. They remained straight throughout processing. The finished ware, furthermore, had an appearance equal to the regular body made by the wet process.

As a means of comparison, many pieces that were made both by the dry and wet processes were put through the bisque as well as the glost kiln at the same time. This assured a similar firing treatment on all the pieces that were used for the test.

The average mixing time would be well within twelve minutes per batch, and the production is estimated at five batches per hour.

VI. Heavy and Light Refractories and Saggers

Outstanding results have been obtained in the heavy refractories division by the preparation of batches by the dry-mixing method. Uniform dispersion is essential with complete coating of nonplastic materials with the finely divided plastics. An important requisite is preservation of the formulated grain size, shape, and structure.

A total absence of lumps or nodules is important to assure uniformity of the structure of the finished refractory product. This is obtained by proper sequence of feed.

Dry mixing in this field has proved satisfactory and can meet high tonnage because the mixing time is short; 12 to 20 batches per hour can be produced.

Light refractories require their own treatment, depending upon the materials used. While there are no set methods of mixing procedure, a fluffing action is desired, at the same time evenly distributing the plastic and bonding materials throughout the lighter ingredients.

Sagger batches are being prepared by the same type of equipment, and while they do not come within the scope of dry mixing, they are in the refractories division. Again the need for uniformity in structure was met, and the results show a longer life with fewer failures from cracks or other breakdown in the sagger structure.

(1) Extracts from Reports of Mixing Operations

Plant No. 1, using dry-mixing equipment for three years, reports that uniformity in grain-size distribution and moisture gives finished results not obtainable by any other system.

Plant No. 2 reports that proper coating of the nonplastic grains has eliminated screening and that refractory shapes

with better surfaces and more uniform structure are produced.

Plant No. 3 is producing a batch in 2 minutes mixing time, using 6% moisture; there are no lumps in the finished mix.

Plant No. 4 (refractories manufacturer) states that dry-mixing equipment gives a thoroughly mixed batch.

VII. Casting Slips

Casting slips for artware and refractory production are being made regularly by the dry-mix method.

In one installation of small capacity, the ball clays are soaked with the required amount of water and deflocculators for 12 hours; the slip is screened into the mixer; the remainder of the finely divided air-floated material is added and mixed with the slip for 10 minutes. The slip is then placed in storage, ready for use.

Several producers of the plastic and semiplastic bodies obtained good results in mixing casting slips by this method.

The soaking operation can be eliminated by blending and mixing all the ingredients in the mixer itself. The use of air-floated ball clay would be necessary.

VIII. Summary

The dry-mixing process offers many economies and advantages, all of which justify serious investigation on the part of the ceramic manufacturers. The method offers an economy in investment and a great reduction in the amount of floor space required for new plant installations.

This process not only eliminates a number of operations that are necessary with the wet process, but a consequent reduction in maintenance and operating cost would naturally follow the elimination of these operations.

It is interesting to compare the various operations of the two processes; there are eleven operations in the wet process, *viz.*, raw material storage, weighing, blunging, lawning, magnetic separation, slip storage, filter pressing, drying filter cake, crushing filter cake, soaking filter cake, and grinding wetted filter cake to size.

In the dry-mixing process, the four operations are unmixed material storage, weighing, dry mixing, and grinding mixed material to size.

Screening and magnetic separation with dry mixing depend on local conditions.

The disposition of scrap has frequently been discussed. A checkup on actual operations indicates that the dry scrap can be put back into the mixer either as one batch or as a part of each new batch. Ordinary precaution must be taken to keep the scrap clean.

It is obvious that the dry-mixing method requires less equipment, and some of the advantages to be gained are as follows: (1) saving of labor for handling the materials and for operating the equipment eliminated; (2) considerable reduction in power requirements and maintenance costs; (3) wider range of plasticity; mixing operation develops plasticity (with the old method, this was obtained by means of weathering and storing); (4) easier means of cleaning when changing from one type of body to another; (5) small special batches can be prepared, eliminating the need of making several tons of one body for a small quantity; (6) saving of storage space required by the wet process for storing material going through the various processes, including drying; (7) saving of space required by large preparing equipment of the wet process; (8) conservative estimates establish the savings from between $1.50 to $3.00 per ton; (9) considerable savings effected in installation of new equipment; (10) intangible savings by close moisture control, reducing amount of defective ware; apparent improvement in handling materials in press dies; (11) in the exact words of one user, "dry mixing takes the slop out of the slip house"; and (12) recent investigation indicates definite possibility that valuable ingredients in the clays are washed out as the clays are filter-pressed; such losses are definitely eliminated by dry-mixing; there would also be the savings in water, because only the exact amount is introduced that is required for the desired plasticity.

Dry mixing entails new methods in handling, processing, and operating. The old method is obsolete. Consequently, the old process must be changed; formulas must be changed; thorough investigations and tests are needed; and careful studies of the available materials should be made to work out formulas suitable for each requirement.

All this has had to be done by those using this method. Similar work will have to be done for and by those who will adopt dry mixing.

The representative list of dry-mixing users attests to the fact that this can be done and that adjustments and changes necessary for the use of dry mixing will be made.

Lancaster Iron Works, Incorporated
Lancaster, Pennsylvania

THE EXPANSION CHARACTERISTICS OF KYANITE AND KYANITE-CLAY MIXTURES WHEN HEATED*

By Gordon R. Pole and D. G Moore

Abstract

Using kyanite of 90 to 95% purity, studies were made of the effect of grain sizing on the expansion of raw kyanite and kyanite-clay bodies when heated. These bodies were made both by dry pressing and by wet casting. Expansions of the test pieces were measured by means of an "Ames" dial-type dilatometer apparatus while the pieces were heated in a furnace. Inasmuch as the expansion resulted from decomposition of the kyanite, it was inferred that the rate of linear expansion of the kyanite was a satisfactory measure of the rate of decomposition. Porosities and apparent specific gravities were determined on the test pieces before and after heating.

The relation of grain size and clay content to the expansion and increase in porosity was established quantitatively, and curves were plotted showing these relationships. Cast pieces had approximately the same expansion but lower porosity when compared with dry-pressed pieces of the same grain size and clay content. The results indicated that dense bodies could be obtained by using finely ground kyanite.

Utilizing the information obtained in these studies kyanite insulating brick were made from mixtures of kyanite, clay, and sawdust in various proportions. The physical properties of these insulating brick, such as porosity, bulk specific gravity, P.C.E., crushing strength, and shrinkage at cone 30 were determined. The insulating brick compared favorably with commercial products.

I. Introduction

The mineral, kyanite, is found in the Atlantic coast states from New Hampshire to Georgia, with the more important commercial deposits located in Virginia, North Carolina, and Georgia. It occurs principally in gneiss and mica schists, and it is often associated with garnet, staurolite, rutile, and lazulite.

Kyanite belongs to the sillimanite group of minerals which have the general formula $Al_2O_3 \cdot SiO_2$. Pure kyanite has a softening point of about cone 36 (1810°C approx.) and, when heated above cone 12 (1310°C approx.), it decomposes into mullite ($3Al_2O_3 \cdot 2SiO_2$) and SiO_2. This decomposition is accompanied by an increase in volume and a change in specific gravity from about 3.5 to 2.9.

Because of general interest in the development of "super-refractories" and insulating brick for high-temperature furnaces, the present work was undertaken to investigate the expansion characteristics of kyanite and kyanite-clay mixtures when heated above the decomposition temperature. It was believed that, by properly compounding bodies of clay and kyanite of controlled grain size, it would be possible to regulate the expansion of the fired product to obtain either a dense, highly refractory material or a porous, insulating body.

Some of the first work on kyanite, which dates from about 1924, was carried out by Peck[1] and Greig.[2] Peck heated powdered samples of raw kyanite at various temperatures and examined the resulting product for changes in the optical properties. Determinations were also made of the changes in specific gravity of the fired and unfired kyanite. Peck concluded that kyanite dissociated into mullite and a siliceous glass at about cone 12 (1310°C approx.), accompanied by marked disintegration and a large increase in volume at its dissociation point.

Greig[2] heated powdered samples of kyanite. He also obtained differential heating curves and concluded that kyanite changed at a lower temperature than either andalusite or sillimanite and that this transformation did not occur at a definite temperature; the temperature observed, however, depended on the size of grain and the rate of heating. He also reported that when kyanite decomposed, the transformation commenced on the surface of the grain and advanced inward, with parallel mullite needles forming perpendicular to the original kyanite surfaces from which the initial

* Presented at the Fortieth Annual Meeting, American Ceramic Society, New Orleans, La., March 31, 1938 (Refractories Division). Received March 10, 1938.

[1] A. B. Peck, "Changes in Constitution and Microstructure of Andalusite, Kyanite, and Sillimanite at High Temperatures and Their Significance in Industrial Practice," *Jour. Amer. Ceram. Soc.*, **8** [7] 407–29 (1925).

[2] J. W. Greig, "Formation of Mullite from Kyanite, Andalusite, and Sillimanite," *ibid.*, **8** [8] 465–83 (1925).

growth started. In addition, Greig found that the decomposition of kyanite was accompanied by an absorption of heat.

Harrison[3] studied the changes in specific gravity by the pycnometer method, using a coarse (20- to 65-mesh) and a fine (−300-mesh) kyanite concentrate of 83% purity, resulting from heating at constant temperatures (1000° to 1350°C) for periods of one-half hour. He found that the fine material started to dissociate, and the dissociation was completed at a lower temperature than was required with the coarser concentrate. Linear firing shrinkages and porosities were determined on small kyanite-clay briquets after firing to various temperatures. Brick made from these kyanite-clay mixes in most cases showed high porosities and high firing expansions.

Other investigators have made studies on kyanite similar to those cited (see Bibliography, p. 367).

In this investigation, quantitative measurements were made on the expansions of kyanite of different grain sizes with and without the addition of clay when heated at a constant rate of 4°C per minute. Expansion-rate studies were also made on raw kyanite of various grain sizes, when heated at constant temperatures, as a means of measuring the rate of decomposition.

II. Composition and Preparation of Materials

(1) Kyanite

The kyanite used in these experiments was obtained from the Black Mountain region of North Carolina and had been purified and concentrated by means of a tabling and flotation process. The various screen fractions used in these studies were

TABLE I

CHEMICAL ANALYSES OF KYANITE FLOTATION SAMPLES

Coarse (8- to 40-mesh) (%)		Fine (98% −100-mesh) (%)	
SiO_2	40.4	SiO_2	37.3
Al_2O_3	57.4	Al_2O_3	59.8
Fe_2O_3	0.5	Fe_2O_3	0.4
TiO_2	0.9	TiO_2	1.1
CaO	0.8	CaO	1.2
MgO	Trace	MgO	Trace
Ignition loss	0.1	Ignition loss	0.2
Total	100.1	Total	100.0

obtained from two large samples of the concentrate, one of 8- to 48-mesh sizing and the other a fine sample, 98% of which passed a 100-mesh standard sieve. The physical and chemical properties, together with the results of the microscopic examination of these two kyanite samples, are given in Tables I, II, and III.

TABLE II

MICROSCOPIC EXAMINATION OF KYANITE FLOTATION SAMPLES, UNCALCINED AND CALCINED

Coarse (8- to 48-Mesh) Uncalcined

Major part of sample showed well-developed bladed crystals of kyanite of a light blue color; quartz was present in small quantities, 5% or less; some reddish-brown, semi-opaque crystalline material was thought to be staurolite, which appeared to be intergrown with the kyanite crystals.

Coarse (8- to 48-Mesh) Calcined at 1450°C for One Hour

The bulk of the sample had been converted to mullite and glass with an index of refraction of 1.62 to 1.63; the reddish-brown staurolite and quartz appeared to be unchanged; the calcined grains had a light gray color with very small dark specks.

Fine (98% −100-Mesh) Uncalcined

The appearance of this sample was similar to that of the coarse fraction with the possible exception of less quartz being present.

Fine (98% −100-Mesh) Calcined at 1450°C for One Hour

Appearance the same as for the coarse calcined fraction.

TABLE III

SPECIFIC GRAVITIES OF KYANITE FLOTATION SAMPLES

Samples	Specific gravity at 20°C
Coarse (8- to 48-mesh) uncalcined	3.505
Coarse (8- to 48-mesh) calcined at 1450°C for 1 hour	2.995
Fine (98% −100-mesh) uncalcined	3.545
Fine (98% −100-mesh) calcined at 1450°C for 1 hour	2.990

Seven different screen fractions of raw kyanite were used in this work. The coarse (8- to 48-mesh) kyanite was ball-milled in a porcelain jar with flint pebbles and then screen-separated in order to obtain the 48- to 60-mesh, 60- to 80-mesh, and 80- to 100-mesh materials. The 100- to 150-mesh, 200- to 325-mesh, and minus 325-mesh fractions were obtained from the fine (98% minus 100-mesh) kyanite. All the screening was done with standard screens using a Tyler Ro-Tap sieve shaking machine. About 500 grams of the raw kyanite were screened through a given screen series at a time, and the material was shaken for a 30-minute period to insure good separation of the fractions. The 200- to 325-mesh fraction was screened for 60 minutes to remove the minus 325-mesh material more thoroughly.

A photomicrograph of the 100- to 150-mesh screen fraction of kyanite used in these experiments is shown in Fig. 1. Small pieces of quartz impurities (light colored) may be seen in the

[3] H. C. Harrison, "Kyanite-Clay Refractories," *Jour. Amer. Ceram. Soc.*, **9** [5] 257–71 (1926).

FIG. 1.—100- to 150-mesh kyanite, 50×.

lower right-hand corner. Similar photomicrographs made on the finer grain sizes showed more dust particles than the coarser fractions.

(2) Clays

A washed Florida kaolin and a No. 5 Tennessee ball clay were used in all these experiments. The chemical analyses are given in Table IV.

The clay used was a mixture of equal parts of Tennessee ball clay No. 5 and washed Florida kaolin. The clays were mixed thoroughly as a slip and passed through a 30-mesh screen. The wet slip was then dried on plaster slabs and reground and screened through a 30-mesh sieve. This mixture was used throughout all the experiments.

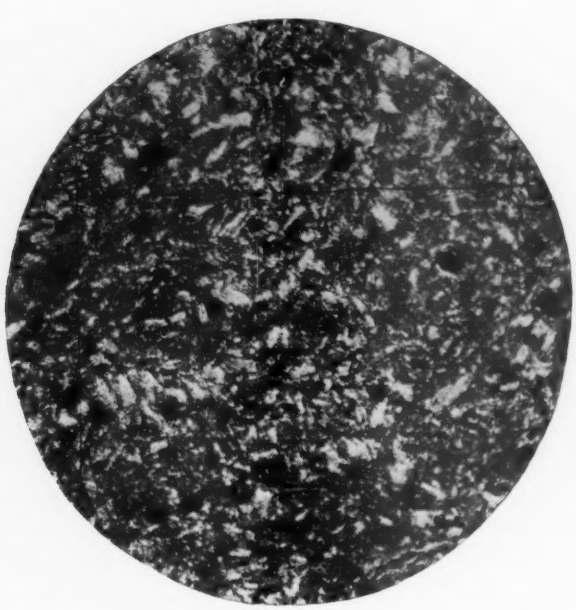


FIG. 2.—Minus 325-mesh kyanite, uncalcined, 100×.

(3) Electrolytes

An electrolyte composed of 80% by weight of "N" brand sodium silicate and 20% by weight of C.P. sodium hydroxide was used for deflocculating the cast specimens. The solution was made up so that 1 cubic centimeter contained 0.2 gram of solids.

FIG. 3.—Minus 325-mesh kyanite, calcined at 1450°C, 100×.

TABLE IV

CHEMICAL ANALYSES OF CLAYS

Tenn. ball clay No. 5 (%)		Florida kaolin (%)	
SiO_2	53.8	SiO_2	47.0
Al_2O_3	29.0	Al_2O_3	36.8
Fe_2O_3	1.1	Fe_2O_3	0.8
TiO_2	1.8	TiO_2	0.2
CaO	1.3	CaO	0.1
MgO	Trace	MgO	0.2
K_2O	1.0	Alkalis	0.2
Na_2O	0.3	Ignition loss	15.0
Ignition loss	9.9	Total	100.3
Total	98.2		

(4) Nomenclature of Samples

In order to simplify the identification of samples, the kyanite screen fractions were given the following numbers:

No.	Screen sizing	Average grain diameter (mm.)*
1	Through 48 on 60	0.27
2	" 60 " 80	.21
3	" 80 " 100	.16
4	" 100 " 150	.12
5	" 150 " 200	.09
6	" 200 " 325	.06
7	" 325	.02

* The average grain diameter was determined from the mathematical mean of the two limiting screen openings.

Each kyanite-clay mixture was coded by a letter to indicate the clay content of each batch. The letters used for this purpose were as follows:

Letter	Clay (%)	Method of making
A	0	Dry pressed
B	15	" "
C	30	" "
D	30	Cast

A simple means of identification resulted by using this system of symbols. For example, a specimen marked 5B–1 refers to a dry-pressed body made up of 150- to 200-mesh kyanite and 15% clay, and the "1" is the sample number of a particular specimen of the 5B mixture.

FIG. 4.—60- to 80-mesh kyanite with 15% clay, uncalcined, 50×.

III. Preparation of Specimens

In preparing the dry-pressed specimens, the clay and kyanite, in the proper proportions, were first mixed thoroughly and then enough water was added to make a wet plastic mass. The wet mixture was then dried on plaster slabs to the proper consistency for pressing. The material was pulverized sufficiently so that it all passed a 30-mesh screen.

Five per cent of a 5% dextrine solution was added to mixtures 1B, 2B, and 3B to give the test pieces sufficient strength for working. Mixes 5A, 6A, and 7A were bonded by a 30% dextrine solution. The amount of dextrine added to each mixture was as follows: 5A, 1.4%; 6A, 1.6%; and 7A, 2.1%.

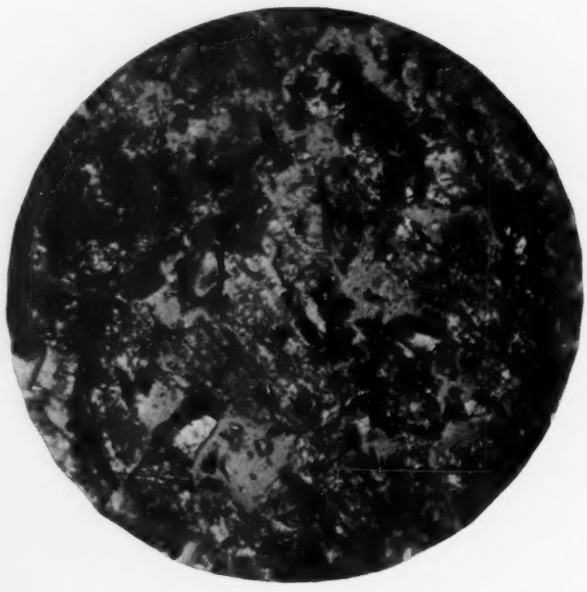


FIG. 5.—60- to 80-mesh kyanite with 15% clay, calcined at 1450°C, 50×.

The dry-pressed specimens were formed by pressing the desired mixture into bars, 5 by 1 by 1 inch, at 8000 pounds per square inch by a hydraulic press. The total pressure was applied, released, and then re-applied to expel as much entrapped air as possible.

TABLE V

MOISTURE CONTENT OF DRY-PRESSED KYANITE MIXTURES*

Mixture No.	Water (%)	Mixture No.	Water (%)
5A	3.5	6B	6.5
6A	3.8	7B	10.1
7A	7.3	1C	5.7
1B	3.4	4C	5.6
2B	3.5	5C	3.9
3B	3.6	6C	3.4
4B	4.5	7C	4.8

* Expressed in terms of the dry weight.

The water content of the pressed mixes was determined by weighing the pressed specimen im-

mediately after pressing and again after drying at 110°C. The amount of moisture determined in this manner is given in Table V.

In preparing the cast specimens, the clay was weighed out and deflocculated by slowly adding it to the water and electrolyte with constant stirring. In all cases, 0.2% of electrolyte on the dry-batch basis was used. After the clay had been thoroughly broken down and deflocculated, the kyanite was slowly added. The resulting mixture was then stirred until the slip became homogeneous; the total mixing time was approximately 10 minutes. The mixture was then poured into a plaster mold forming a 1-inch cylindrical test specimen 3 inches long. The plaster mold was tapped during the casting process to eliminate as many bubbles as possible. The specimens were removed from the mold as soon as they were firm enough to handle.

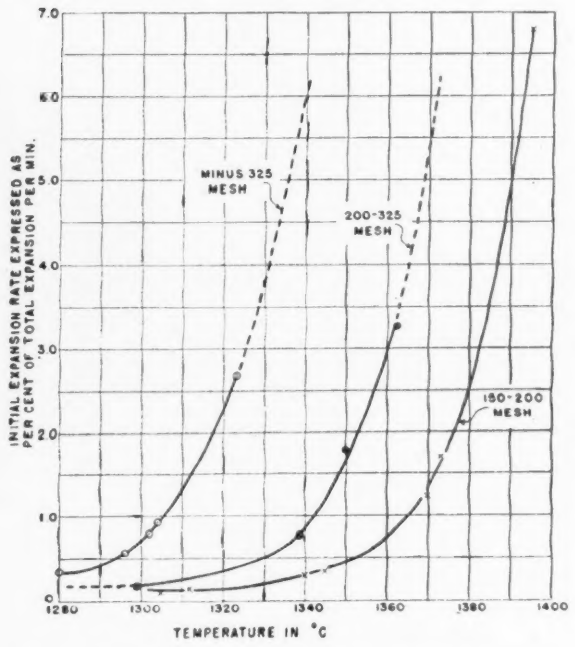

INITIAL EXPANSION RATE EXPRESSED AS PER CENT OF TOTAL EXPANSION PER MIN.
MINUS 325 MESH
200-325 MESH
150-200 MESH
TEMPERATURE IN °C

FIG. 6.—Curves showing effect of temperature on initial expansion rate.

A summary of the compositions of the test specimens prepared by the dry-pressing and casting process for these experiments is given in Table VI.

The test pieces were prepared from the dry-pressed or cast specimens by cutting to approximately $2\frac{1}{4}$ inches long and then rubbing them down on sandpaper to the proper size and shape. Care was taken to keep the ends and sides square. A $\frac{1}{4}$-inch round hole, $1\frac{1}{4}$ inches deep, was drilled in the center of one end so that the platinum thermocouple well could be inserted. The finished test specimen was cylindrical, approximately $\frac{7}{8}$ inch in diameter and 2 inches long.

TABLE VI

MIXTURES USED IN KYANITE EXPANSION STUDY

Mixture No.	Kyanite screen fraction	Clay content (%)	Method of forming	Av. grain diameter of kyanite from screen openings (mm.)
5A	150–200	0	Pressed	0.09
6A	200–325	0	"	.06
7A	Through 325	0	"	.02
1B	48–60	15	"	.27
2B	60–80	15	"	.21
3B	80–100	15	"	.16
4B	100–150	15	"	.13
5B	150–200	15	"	.09
6B	200–325	15	"	.06
7B	Through 325	15	"	.02
1C	48–60	30	"	.27
4C	100–150	30	"	.13
5C	150–200	30	"	.09
6C	200–325	30	"	.06
7C	Through 325	30	"	.02
1D	48–60	30	Cast	.27
4D	100–150	30	"	.13
5D	150–200	30	"	.09
6D	200–325	30	"	.06
7D	Through 325	30	"	.02

IV. Expansion Tests

The apparatus used to measure the thermal expansions of the kyanite and kyanite-clay mixes was similar to that used by Chesters and Par-

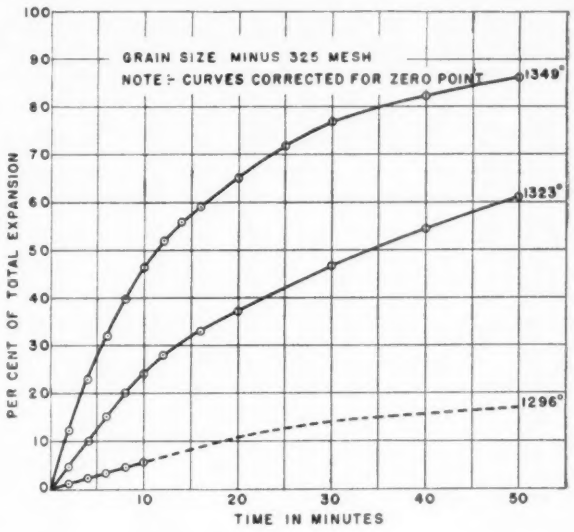


FIG. 7.—Typical rate curves for minus 325-mesh specimens.

melee[4] in measuring the reaction rates of refractory materials at high temperatures.

Temperatures were taken by means of a calibrated platinum-platinum 10% rhodium thermo-

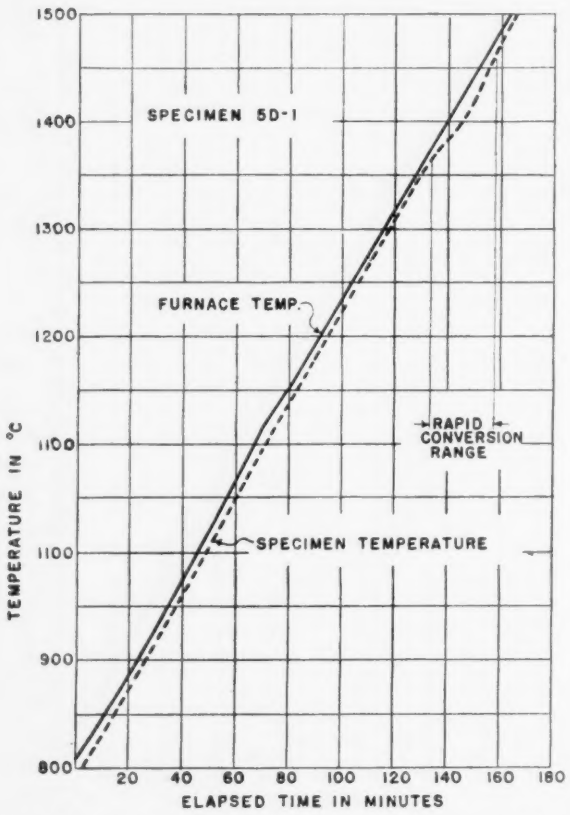


FIG. 8.—Time-temperature curve for kyanite expansion studies; constant heating rate of 4°C per minute.

couple connected to a Leeds and Northrup double-range type of portable potentiometer.

(1) Tests on Kyanite at Constant Temperature

In these experiments, the length of the test piece was measured accurately to the closest 0.01 centimeter. The specimen was then placed in the expansion apparatus, and the furnace was heated to a temperature of about 1250°C in three hours. From this point, the temperature was increased at a uniform rate of 4°C per minute until the expansion started. The start of the expansion was determined by means of the dial micrometer and served as the zero point in the calculations. The temperature was increased rapidly up to the desired temperature of test and held constant ±2°C by careful manipulation of power input. Early in the experiments, it was found that the expansion continued at a reasonably constant rate until about 20 to 30% of the total expansion had taken place. This permitted several determinations of the initial rate at succeedingly higher temperatures over the slow expansion range. For example, the temperature was first raised rapidly to the desired value and held constant for five to ten minutes; readings were taken each minute. The temperature was then raised rapidly about 10°C higher and another determination was made. When the total expansion was still small, a third

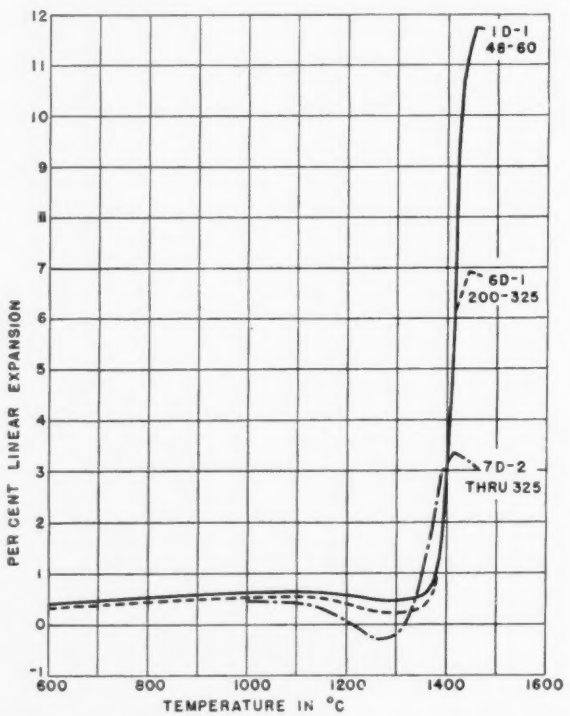


FIG. 9.—Typical expansion curves for cast specimens containing 30% clay when heated at 4°C per minute.

determination was possible. In these runs, the data were not used to determine the initial rate unless the points fell in a straight line when plotted against time.

For the higher temperatures, the foregoing procedure could not be used because it was not possible to raise the temperature of the specimen rapidly enough for the initial rate determination; it was necessary, therefore, to make an individual run for each expansion rate determination. The following method was used: The expansion apparatus with the specimen already placed in position was first lowered into the furnace to

[4] J. H. Chesters and C. W. Parmelee, "Measurement of Reaction Rates at High Temperatures," *Jour. Amer. Ceram. Soc.*, **17** [3] 50–59 (1934).

such a point that, upon heating, the temperature of the test piece would not exceed 1260° to 1280°C. At the same time, the hot zone of the furnace was brought to the desired temperature of test. When this temperature was reached, the dial was set at zero and the apparatus quickly lowered into the furnace. Readings were started and the heating adjusted so that a constant temperature was reached within four or five minutes. By this means, only a small percentage of the total expansion had taken place before the desired temperature was reached and the initial rate could be determined with reasonable accuracy. In only one case (Fig. 7, upper curve) was the expansion rate changing so fast as to make a determination of the initial rate impossible. The final dial reading or the total expansion of each test piece was

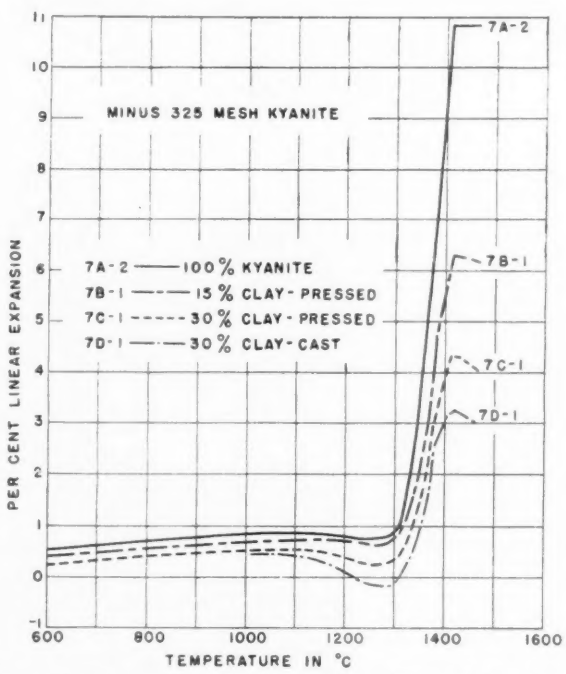


FIG. 10.—Expansion curves for minus 325-mesh kyanite when heated at 4°C per minute.

obtained by heating the specimen to 1450°C after the rate data had been obtained. In a few cases, the total expansion was computed from the results of previous runs.

(2) Tests on Kyanite and Kyanite-Clay Mixtures at Constant Heating Rate

In these experiments, the specimens were measured to the closest 0.01 centimeter, placed in the expansion apparatus, and the dial reading was obtained at room temperature. The furnace was then heated to 800°C in about $2^1/_2$ hours; no readings were taken below 800°C because previous determinations had indicated uniform expansion characteristics below 800°C.

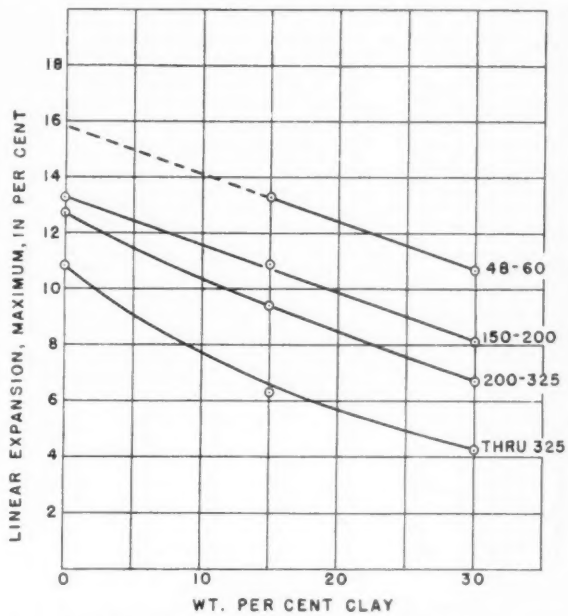


FIG. 11.—Curves showing effect of clay on the maximum linear expansion of kyanite bodies.

From 800° to 1450°C, the rate of heating the furnace was maintained at 4° ± 0.5°C per minute. Temperature and dial readings were taken each ten minutes up to the time when conversion started and each five minutes thereafter. The percentage expansion was corrected for the expansion of that portion of the outer Alundum tube of the same length as the specimen. The average expansion of the Alundum tube was determined as 7.2×10^{-6} inch per inch per °C. With a heating rate of 4°C per minute, the temperature differential between the two Alundum tubes was not of sufficient magnitude to influence the dial readings.

(3) Determination of Porosity

The apparent porosities were determined by the saturated weight method. Kerosene of known specific gravity was used for the unfired specimens, and the pieces were saturated under vacuum for 2 hours. The fired specimens were saturated by boiling two hours in water.

V. Results and Discussion

The results of these experiments are summarized in Table VII and Figs. 6 to 14, inclusive.

TABLE VII

POROSITIES AND LINEAR EXPANSIONS OF KYANITE BODIES

Specimen No.	Initial porosity (%)	Final porosity (%)	Increase in porosity (%)	Max. linear expansion (%)	Fired structure
5A–1	32.1			13.28	Almost zero strength
6A–2	36.0			12.72	Easily crushed in hand
7A–2	38.3	46.0	7.7	10.88	Soft chalky structure
1B–2	20.3	42.4	22.1	13.32	Very soft (punky)
2B–1	21.1	41.5	20.4	12.52	Soft (punky)
3B–1	23.8	44.3	20.5	12.35	" "
4B–1	24.7	43.3	18.6	12.12	Soft
4B–1	26.3	41.6	15.5	10.48	Medium strength
5B–2	28.4	44.0	15.6	11.38	" "
6B–1	27.5	39.5	12.0	9.42	Fair strength
6B–2	26.0	37.5	11.3	9.35	" "
7B–1	29.0	33.6	4.6	6.30	Good strength
1C–1	17.8	38.0	20.2	10.73	Soft
4C–1	17.5	35.6	18.1	10.62	Medium hard
4C–2	18.4	37.7	18.3	9.57	" "
5C–1	18.3	33.4	15.1	8.00	Hard, good strength
5C–2	18.5	33.4	14.9	8.18	" " "
6C–1	18.6	29.8	11.2	6.72	Hard, strong structure
6C–2	22.9	28.3	5.4	4.31	Very hard
1D–1	34.8	49.4	14.6	11.78	Soft (punky)
4D–1	33.5	46.2	12.7	9.81	Soft
4D–2	33.0	45.4	12.4	9.50	"
5D–1	32.7	45.2	12.5	9.15	Medium hard
5D–2	33.2	45.8	12.6	8.66	" "
6D–1	34.4	43.5	9.1	6.95	Fairly hard
7D–1	31.3	34.5	3.2	3.27	Very hard, strong structure
7D–2	33.6	34.4	0.8	3.34	" " " "

(1) Expansion of Kyanite at Constant Temperature

Greig[2] has shown that when kyanite decomposes, the alteration commences on the surface of the kyanite grains and advances inward. Langmuir,[5] in 1916, worked out the theoretical studies for such a reaction by thermodynamic phase-rule considerations and has shown that the reaction can take place only at the boundary interface between the initial phase and the new phases forming from the decomposition. It is logical, then, that the rate of decomposition at a given temperature is dependent on the crystal surface exposed or the total surface area of the kyanite grains.

The total surface area increases rapidly with decreasing grain size, so that one can expect a much faster rate of decomposition with kyanite passing a 325-mesh screen than with a 150- to 200-mesh kyanite fraction. The curves in Fig. 6 bring out this relationship. In these curves, the initial expansion rates are plotted against the temperature for three different screen fractions. The initial rate is taken from curves such as those shown in Fig. 7, in which it will be noted that the expansion rate decreases with increasing time. This latter effect was probably due to the decrease in the total effective surface area of the kyanite as the decomposition progressed and was more noticeable with the finer grain sizing and became more pronounced at higher tempera-

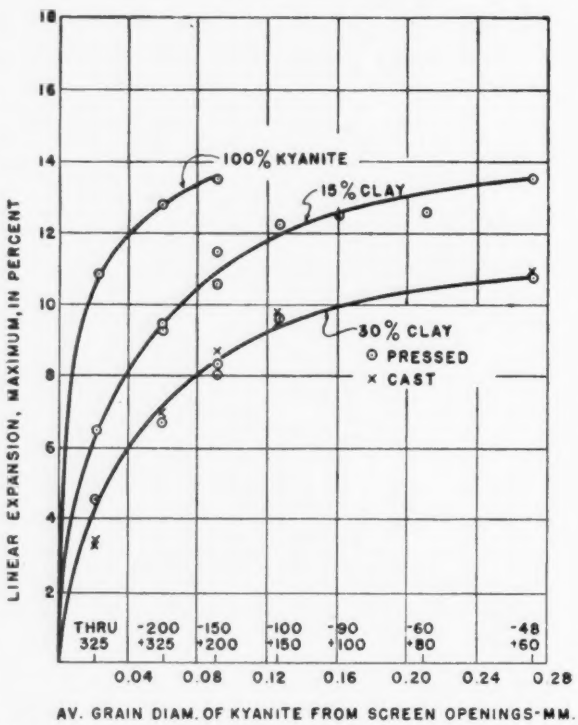


FIG. 12.—Curves showing effect of grain size on maximum linear expansion of kyanite when heated to 1450°C.

[5] Irving Langmuir, "Constitution and Fundamental Properties of Solids," *Jour. Amer. Chem. Soc.*, **38**, 2221–95 (1916).

tures. In most cases, however, the first few minutes of each determination gave points on a straight line, and it was the slope of this portion that was taken as the initial rate. Only in the case of the minus 325-mesh determination at

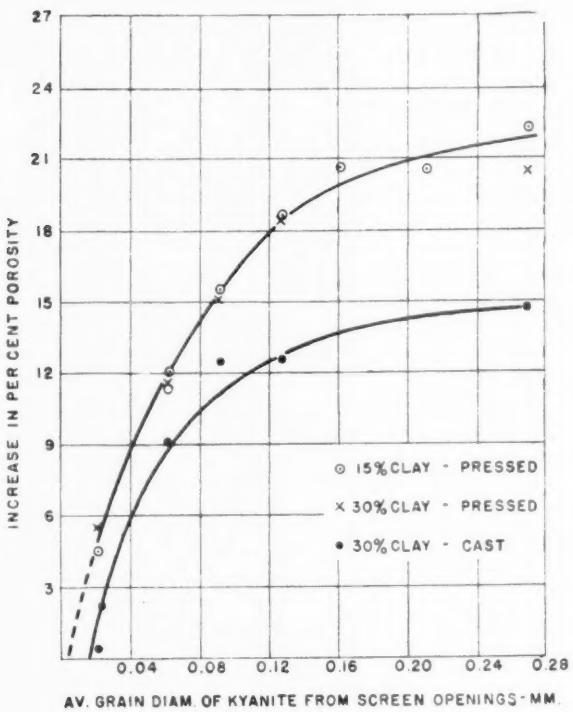


FIG. 13.—Curves showing relation between grain size and increase in porosity of kyanite bodies after heating to 1450°C

1349°C (see Fig. 7) was the slope changing so fast as to make it impossible to obtain a satisfactory value for the initial rate. The presence of very fine dust particles in this fraction would also affect the initial rate determinations to a marked extent.

Although the initial expansion rate is not a direct measurement of the rate of decomposition of kyanite, the expansion nevertheless is directly dependent on the decomposition. In all cases where the specimens were heated until the dial expansion ceased, microscopic examination indicated complete conversion of the kyanite.

Figures 2 and 3 are photomicrographs of sections of a minus 325-mesh kyanite test piece before and after firing to 1450°C, and Figs. 4 and 5 are photomicrographs of a 60- to 80-mesh kyanite plus 15% clay test piece before and after firing to 1450°C. These sections show quite well the effect of heating on the kyanite grains. Figure 5 shows clearly the shattered grains that have converted to mullite and glass.

(2) Expansion of Kyanite and Kyanite-Clay Mixtures at Constant Heating Rate

Figure 8 shows a typical heating curve for kyanite-clay specimens at a constant heating rate of 4°C per minute. Over the rapid conversion range, there is a distinct lag of the specimen temperature behind the furnace temperature, which indicates an endothermic reaction and confirms the findings of Greig.[2] This same effect was noted in all specimens.

Figure 9 shows three typical expansion curves of cast specimens with 30% clay when heated at 4°C per minute. The effect of the shrinkage of the clay in the bodies is first evidenced at about 1100°C and is most pronounced in the minus 325-mesh kyanite-clay mixture. Above 1300°C, the decomposition of the kyanite caused sufficient expansion of the specimen to more than compensate for the shrinkage of the clay. The final expansion was the composite effect of the kyanite

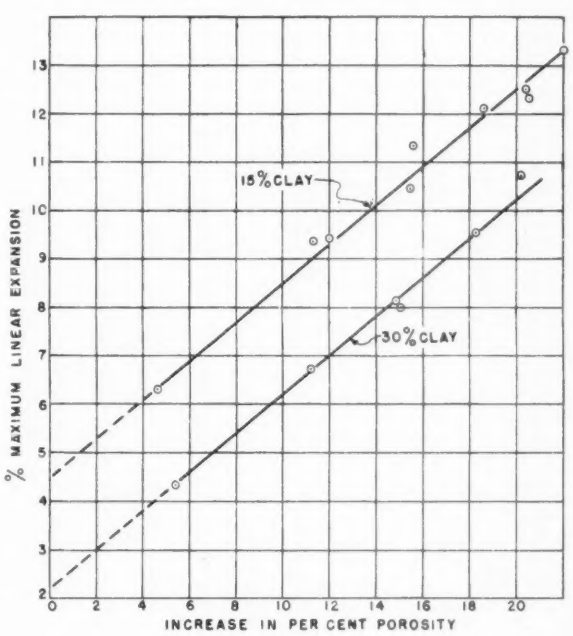


FIG. 14.—Curves showing relationship between increase in per cent porosity and maximum linear expansion for pressed specimens after heating to 1450°C.

expansion and the clay shrinkage. This is brought out in Fig. 10, in which expansion curves are plotted for the minus 325-mesh kyanite with different clay contents. The curves show the cast piece, 7D–1, to have a greater shrinkage than

the pressed body, 7C–1, probably owing to the better coating and dispersion of the clay in the casting process and to possible fluxing effects of the electrolyte. The curves of Fig. 11 show how the addition of clay to raw kyanite lowered the maximum linear expansion in almost a straight-line relationship over the range studied.

The fact that grain size had a marked effect on the expansion of the raw kyanite is brought out by the curves in Fig. 12. The maximum linear expansion is the maximum point on the temperature-expansion curves and is the true expansion of the specimen at the corresponding temperature. The expansion of the piece corrected to room temperature would be a somewhat lower value, owing to the subsequent thermal contraction on cooling. The average grain diameter was computed from the screen openings and is only approximate. The inherent shape of the kyanite grain makes it quite difficult to determine the true average grain size either by screening or by microscopic measurement. This can be seen by examining the photomicrograph of the 100- to 150-mesh screen fraction shown in Fig. 1.

In Fig. 13, curves are plotted to show how the porosity of the specimen increased with the grain

FIG. 15.—Kyanite insulating brick No. 1, fired to cone 15, 5×.

size. The increase in porosity of the pressed specimens seemed to be independent of clay content over the range studied and was a function of grain size only. This is borne out by the upper curve in Fig. 13, with both the 15 and 30% clay values falling on the common curve. The cast specimens, however, show a smaller increase in porosity for all sizes. This is probably due to

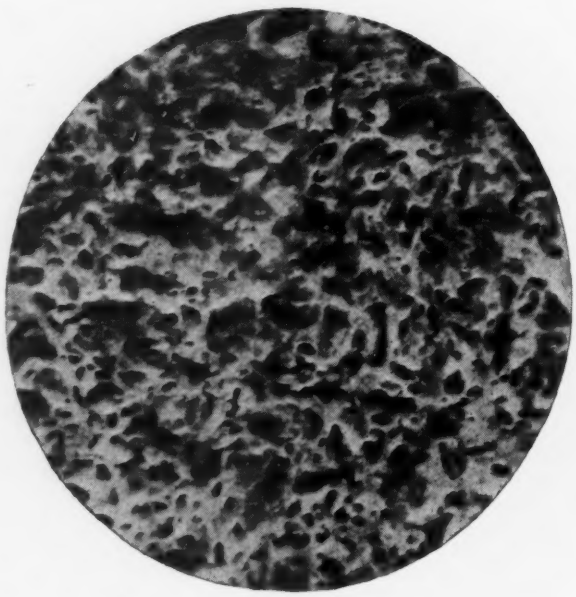


FIG. 16.—Kyanite insulating brick No. 1, fired at 1650°C, 30 minutes, 5×.

the presence of air bubbles in the cast specimens which would affect both the initial and final porosities without affecting the linear expansion. It is also possible that the small amount of electrolyte used in the casting process affected the porosities of these test pieces.

Figure 14 shows the relationship between increase in porosity and linear expansion for the the pressed specimens. From the work of Chesters and Parmelee[4] on spinels and quartzite, it can be concluded that the increase in porosity as measured by the linear expansion of the kyanite-clay test specimen was due to a change in the molecular structure of the kyanite during the conversion process. Figure 14 indicates that the amount of expansion was directly proportional to the increase in porosity.

VI. Kyanite Insulating Refractories

Utilizing the data obtained in this investigation on the expansion of raw kyanite-clay mixtures, a series of experiments was carried out on raw kyanite-clay-sawdust mixtures to determine the best proportions for making an insulating refractory. Small test bars were made up of various proportions of these materials by dry

pressing and by hand pressing into molds. The test pieces were fired to cone 15 (1435°C) and the physical properties, such as firing shrinkage, porosity, compressive strength, bulk specific gravity, apparent specific gravity, and P.C.E. values were determined.

Standard 9-inch brick were made from two of the most promising experimental batches, the compositions of which are given in Table X. The dry batches of approximately 60 pounds were

FIG. 17.—Kyanite insulating brick No. 2, fired to cone 15, 5×.

first thoroughly mixed by hand in a large tub and then water was added and the batch was mixed until it had a homogeneous appearance. The wet batches were covered with damp burlap sacks and left to age. Batch No. 1 was aged for 48 hours; batch No. 2, for 24 hours. After aging, each batch was pugged in a small sigma-blade mixer before pressing. The brick were formed by pressing in a lubricated steel brick mold at 500 pounds per square inch pressure. Batch No. 2 was somewhat fragile after pressing, while batch No. 1 was quite strong and easy to handle. The brick were placed in an electric drier as soon as they were pressed and dried in 20 hours at 105°C. Both batches were fairly strong after drying. Twelve 9-inch standard brick were made from each batch. Raw kyanite of the same composition as that given in Table I was used. The screen analysis of the two kyanite fractions and the white pine sawdust used in the brick batches are given in Table VIII. The chemical analyses of the cone 32 plastic bond clay used in these batches are given in Table IX.

TABLE VIII

SCREEN ANALYSES OF RAW KYANITE AND WHITE PINE SAWDUST USED IN INSULATING REFRACTORY BATCHES

28- to 48-Mesh kyanite (Mesh)	(%)	−100-Mesh kyanite (Mesh)	(%)	White pine sawdust (Mesh)	(%)
On 20	0	On 100	0	On 14	0.0
" 28	16	" 160	24	" 20	7.0
" 40	48	" 200	24	" 40	57.0
" 48	28	Through 200	52	" 60	27.0
Through 48	8			Through 60	9.0

TABLE IX

CHEMICAL ANALYSES OF PLASTIC BOND CLAY

	(%)
SiO_2	52.8
Al_2O_3	31.7
Fe_2O_3	1.7
CaO	0.2
MgO	Trace
Ignition loss	13.6
Total	100.0

TABLE X

COMPOSITION OF KYANITE INSULATING BRICK BATCHES

Batch No. 1 (compositions by % weight)

(%)	
20.3	(28- to 48-mesh) kyanite (uncalcined)
13.5	(−100-mesh) kyanite (uncalcined)
33.8	Plastic bond clay
12.1	White pine sawdust
20.3	Water

Batch No. 2

(%)	
45.5	(−100-mesh) kyanite (uncalcined)
19.5	Plastic bond clay
14.3	White pine sawdust
20.7	Water

The insulating brick were fired to cone 15 (1453°C) in 25 hours. Physical tests were made on the fired brick, together with two brands of commercial grades of clay insulating brick. The results of these tests are given in Table XI. Chemical analyses made on samples of the fired insulating brick are given in Table XII.

One-inch cubes were sawed from each test brick and placed in a small cone fusion furnace, together with two cone 30 pyrometric cones. The furnace was heated to cone 30 in 2 hours and held at that temperature (1640° to 1650°C) for 30 minutes. Both bodies showed about 6% linear shrinkage. Brick No. 1 was more vitrified than No. 2, but both were still quite porous. Photomicrographs were made of the structures of these brick before and after firing to cone 30. These are shown in Figs. 15 to 18, inclusive.

A comparison of the properties of the kyanite insulating refractories with the two commercial brands in Table XI shows that these brick have good P.C.E. values and compressive strengths but higher bulk specific gravities and lower porosities than the two commercial grades of insulating brick. The higher bulk densities in part are due to the fact that the kyanite brick are made from raw materials of higher specific gravity.

TABLE XI

PHYSICAL PROPERTIES OF INSULATING BRICK

Brick No.	Drying shrinkage (% dry length)	Firing shrinkage (% dry length)	Compressive strength (lb./sq. in.)	Apparent porosity (%)	Bulk sp. gr.	Apparent sp. gr.	P.C.E. (cone)	Remarks
Brick No. 1*	2.4	(+) 3.7	312	59.6	1.14	2.82	33	Saws very well
Brick No. 2*	Not determined	(+) 4.1	113	68.9	0.92	2.90	34–35	Saws well; slightly fragile
Commercial brick A			188	76.4	0.62	2.62	28	Saws well
Commercial brick B			214	77.3	0.62	2.73	34	Saws well

* Corresponds to batches No. 1 and No. 2.
(+) Expansion.

TABLE XII

CHEMICAL ANALYSES OF KYANITE INSULATING BRICK

Composition	Brick No. 1 (%)	Brick No. 2 (%)
SiO_2	51.9	46.1
Al_2O_3	45.3	51.4
Fe_2O_3	0.3	0.4
TiO_2	1.7	1.7
CaO	0.5	0.2
MgO	0.0	0.5
Total	99.7	100.3

FIG. 18.—Kyanite insulating brick No. 2, fired at 1650°C, 30 minutes, 5×.

The chemical analyses of these brick show the amount of impurities to be quite low and the alumina content is higher than that of most clay-type insulating refractories. Brick No. 2 could be considered a high alumina type of refractory. Brick of this type resist shrinkage at high temperatures on account of the smaller amount of liquid formed by the low percentage of fluxing oxides.

It was noted during the P.C.E. tests that the cones of many commercial insulating brick had a tendency to shrink markedly near cone 30, even though the fusion point had not been reached. The reheat test and the P.C.E. test on the kyanite-insulating brick indicate that these bodies resist shrinkage at this temperature (cone 30) remarkably well.

VII. Conclusions

(1) The rate of linear expansion of kyanite increased with temperature and with the fineness of the kyanite grains. Inasmuch as the expansion resulted from decomposition of the kyanite, it was inferred that the rate of linear expansion was a satisfactory measure of the rate of decomposition.

(2) In kyanite and kyanite-clay mixtures, the maximum linear expansion increased with increasing kyanite particle size and decreased with increasing clay content.

(3) The porosity of the kyanite specimens increased in all tests after heating to 1450°C. In the case of the dry-pressed specimens, the increase was directly proportional to the maximum linear expansion.

(4) The clay-kyanite mixture in which the average particle size of the kyanite was the largest gave the greatest percentage increase in porosity. In the case of the dry-pressed specimens, the increase in porosity for any given grain sizing

was found to be independent of the clay content up to 30% clay.

(5) Specimens made by the casting process showed approximately the same linear expansion as obtained with mixtures of the same composition prepared by dry pressing.

(6) If kyanite-clay mixtures are to be used in preparing dense refractory bodies, the kyanite must be very finely ground, preferably to pass a 325-mesh screen.

(7) Insulating refractories can be made successfully from kyanite, clay, and sawdust compositions that compare favorably in many respects to commercial types of insulating brick.

TENNESSEE VALLEY AUTHORITY
WILSON DAM, ALABAMA

BIBLIOGRAPHY

(1) N. L. Bowen and J. W. Greig, "The System Al_2O_3–SiO_2," *Jour. Amer. Ceram. Soc.*, **7** [4] 238–54 (1924); correction, **7** [5] 410 (1924).

(2) J. T. Norton, "An X-Ray Study of Kyanite and Andalusite," *ibid.*, **8** [10] 636–39 (1925).

(3) M. L. Freed, "Study of Mullite Refractories Formed by Calcining Kyanite, Their Industrial Application," *ibid.*, **9** [5] 249–56 (1926).

(4) W. J. McCaughey and H. C. Harrison, "Equilibrium Considerations of Kyanite-Clay Refractories: II," *ibid.*, **9** [5] 271–78 (1926).

(5) E. J. Vachuska and G. A. Bole, "Notes on Kyanite and Diaspore Refractories," *ibid.*, **10** [10] 761–73 (1927).

(6) S. J. McDowell and E. J. Vachuska, "Effect of Calcined Kyanite in Porcelain Bodies," *ibid.*, **10** [1] 64–72 (1927).

(7) Anon., "Sillimanite and Kyanite (India)," *Bull. Imperial Inst.*, **24**, 761 (1926); *Ceram. Abs.*, **6** [5] 180 (1927).

(8) W. H. Taylor and W. W. Jackson, "Structure of Kyanite, Al_2SiO_5," *Proc. Roy. Soc.* [London], **A119** [A781] 132–46 (1928); *Ceram. Abs.*, **7** [9] 640 (1928).

(9) H. M. Payne, "North Carolina Kyanite Deposits," *Cement Mill & Quarry*, **32** [12] 75 (1928); *Ceram. Abs.*, **8** [2] 123 (1929).

(10) A. H. Fessler and W. J. McCaughey, "Kyanite as Found in Western North Carolina," *Jour. Amer. Ceram. Soc.*, **12** [1] 32–36 (1929).

(11) Hans Hirsch, "Sillimanite-Kyanite," *Tonind.-Ztg.*, **52** [75] 1512–14 (1928); *Ceram. Abs.*, **8** [9] 659 (1929).

(12) Anon., "Sillimanite," *Blast-Fur. Steel Plant*, **18** [9] 1505 (1930); *Ceram. Abs.*, **9** [11] 942 (1930).

(13) J. A. Dunn, "Aluminous Refractory Materials: Kyanite, Sillimanite, and Corundum in Northern India," *Geol. Surv. India Memoirs*, **52** [2] 145–274 (1929); *Ceram. Abs.*, **9** [3] 201 (1930).

(14) A. F. Greaves-Walker, "Kyanite in North Carolina, Occurrence and Applications," *Eng. Mining Jour.*, **129** [4] 173–74 (1930); *Ceram. Abs.*, **9** [5] 359 (1930).

(15) Alice V. Petar, "Sillimanite, Kyanite, Andalusite, and Dumortierite," *Bur. Mines Information Circ.*, No. 6255, 19 pp. (1930); *Ceram. Abs.*, **9** [7] 535 (1930).

(16) Anon., "Use of Andalusite Minerals in Refractories," *Ceram. Age*, **15** [6] 370 (1930); *Ceram. Abs.*, **9** [12] 1054 (1930).

(17) H. J. Bryson, "Developing North Carolina Kyanite," *Brick Clay Rec.*, **77** [9] 474–81 (1930); *Ceram. Abs.*, **10** [1] 45 (1931).

(18) J. L. Stuckey, "Kyanite Deposits of North Carolina," *Econ. Geol.*, **27** [7] 661–74 (1932); *Ceram. Abs.*, **12** [9] 338 (1933).

(19) A. Lulki, "Using Kyanite in the Russian Ceramic Industry," *Sprechsaal*, **66** [24] 403–405 (1933); *Ceram. Abs.*, **12** [10–11] 383 (1933).

(20) G. L. Efremov, "Kyanite as a High-Refractory Raw Material," *Ogneuporui*, **3**, 135–40 (1935); *Ceram. Abs.*, **14** [8] 189 (1935).

(21) S. R. Scholes, "The Use of Kyanite in Crucibles for Glassmelting," *Bull. Amer. Ceram. Soc.*, **14** [10] 335–37 (1935).

(22) A. A. Litvakovskiĭ, "Application of Highly Refractory Sillimanite Materials in the Glass Industry," *Keram. i Steklo*, **11** [8] 26–28 (1935); *Ceram. Abs.*, **15** [2] 63 (1936).

(23) V. A. Ruibnikov, "Kyanite Coating for Tank Blocks with a High Grog Content," *Keram. i. Steklo*, **12** [1] 12–14 (1936); *Ceram. Abs.*, **15** [8] 243 (1936).

(24) W. C. Rueckel, "Physical Properties of Some Insulating Brick," *Jour. Amer. Ceram. Soc.*, **18** [1] 18–22 (1935).

(25) W. M. Hepburn, "Insulating Refractories," *ibid.*, **18** [1] 13–17 (1935).

Membership in American Ceramic Society
FOR CONTINUING EDUCATION IN CERAMICS
Forward-going aggressive persons succeed only by continually studying, not narrowly, but broadly the current problems in all ceramic fields.

CELO KYANITE
UNIFORM QUALITY DEPENDABLE SUPPLY
FOR INFORMATION AND SAMPLES WRITE TO
CELO MINES, INCORPORATED
BURNSVILLE, NORTH CAROLINA

CERAMIC HISTORY

THEODORE AHRENS*

Humanitarian, friend of youth, champion of trades education, once a Master Plumber, and a leader of the plumbing industry, this was Theodore Ahrens, chairman of the Board of the Standard Sanitary Mfg. Co., who died Sunday, June 12, 1938, in Louisville, Ky.

To those who knew Mr. Ahrens best, the close friends and business associates he had made in his 65 active years and in his world-wide travels, he was not a giant of industry, but just a man to whom amassing a fortune meant naught as compared to the gathering of friends and the sowing of the seeds of idealism.

Mr. Ahrens boasted no college diploma. In an elementary school he acquired what "book learning" he had, but he was an honor graduate in the university of experience, and here he developed the engaging personality and idealism that was to make him a man loved and respected by his fellow men.

Great personal wealth was never the aim of Mr. Ahrens, nor did he ever seek for himself personal glory which might have come to him, had he desired it, from the humanitarian deeds which dotted his pathways.

Typical of this desire to aid youth was his establishment in Louisville, Kentucky, of a school where trades are taught under the supervision of the Board of Education. In his honor, the school was named the Theodore Ahrens Trade School.

In recognition of Mr. Ahrens' keen interest in trades education, his associates in the Standard Sanitary Manufacturing Company established in 1925 at Carnegie Institute of Technology the Theodore Ahrens Professorship of Plumbing, Heating, and Ventilating, which has as its objective the promotion of scientific education in the field of plumbing, heating, and ventilating, the first such chair established in any educational institution in the world.

In 1926 the Women's Auxiliary of the National Association of Master Plumbers founded a scholarship in Mr. Ahrens' honor at Carnegie Institute of Technology.

Establishment of the plumbing trade apprenticeship school in Pittsburgh, at the Grant School, found Mr. Ahrens president of the commission which coöperated with the Pittsburgh Board of Public Education in founding the school, in which all plumbers' apprentices are required to attend in connection with their learning the trade.

Mr. Ahrens was born in Baltimore, Md., September 21, 1859. He started to learn the trade of brass molder and finisher at the age of 13. Five years later he was with Haydenville Brass Factory in Haydenville, Mass., and after that with Nathan & Dreyfus, New York, N. Y.

At 21 years of age, Mr. Ahrens became a member of the plumbing firm of Ahrens, Walker & Ryan, in Louisville, and for six years he was a Master Plumber.

In 1885 Mr. Ahrens joined his father and Mr. Henry Ott in conducting the brass work foundry which had started in 1860 and which now incorporated a plumbing supply business. By 1894 the Ahrens & Ott Manufacturing Company had become one of the leading cast-iron enameled ware manufacturers, and in December, 1899, the Standard Sanitary Mfg. Co. was born with the consolidation of Ahrens & Ott, the Dawes and Myler Mfg. Co., the Standard Manufacturing Co., and six other plants.

Theodore Ahrens became head of the new organization and headquarters were established in Pittsburgh. The next 30 years saw the expansion of the Standard Sanitary Mfg. Co., continuously under the guiding hand and the sympathetic administration of Mr. Ahrens, to the largest company of its kind in the world.

At the formation of the American Radiator & Standard Sanitary Corporation in March, 1929, Mr. Ahrens held the following offices:

Member of the Board of Directors, President and Member of the Executive Committee of American Radiator & Standard Sanitary Corporation, American Radiator Co., and the Standard Sanitary Mfg. Co.; member of the Board of Directors of the C. F. Church Mfg. Co., from the time of its purchase in 1929.

Mr. Ahrens held the three presidencies for one year; after that time he retired as President of the Standard Sanitary Mfg. Company and of the American Radiator Company, and became Chairman of the Board of the Standard Sanitary Mfg. Co.

He continued to serve as President of the American Radiator & Standard Sanitary Corporation until March, 1934, retiring then at his own request.

* From *The Standard News*, **3** [7] (1938).

LAURA ANNE FRY: ORIGINATOR OF ATOMIZING PROCESS FOR APPLICATION OF UNDERGLAZE COLOR*

By Kenneth E. Smith

Born January 22, 1857, in White County, Indiana, Miss Fry is still living in Cincinnati, Ohio, wishing that she could continue her fascinating work. She feels, however, that she must look upon her work as a "finished experience" owing to ill health. With an active mind and a keen sense of humor, Miss Fry has related to the writer a detailed account of her life devoted to the many phases of pottery decorating and teaching.

In a book entitled Ohio Art and Artists by Edna Clark, the following brief sketch is given:

"Fry, Laura A.: Cincinnati, Ohio. Pupil of Noble and Rebisso; A.S.L. of New York City. Studied in France and England. Awards: two medals Columbian Exposition 1893; three prizes in woodcarving, Cincinnati. Member: Cincinnati Pottery Club, Cincinnati Women's Art Club, Lafayette Art Association. Head, Art Department, Purdue University. Paints individualistic; still life; good feeling for color."

As varied and interesting a life as this one would indicate, there are but few hints as to her many years of interest and success in pottery work.

Laura Fry was one of ten children of the late William H. Fry who moved from Indiana to a large farm on Indian Hill near Cincinnati in 1867. At an early age, Laura was carefully instructed in design, as both her father and grandfather, who were born in England, had been trained in the best English manner and both were woodcarvers of exceptional ability. Henry L. Fry, her grandfather, had worked under Grinling Gibbons in England and had done much woodcarving in the House of Parliament. He also carved the throne chair which was used by Queen Victoria

* Presented in the Fine Arts Department, Ohio State University. Received August 9, 1938.

Her father, William H. Fry, taught for about half a century at the Art Academy in Cincinnati until he reached the age of 96. Specimens of William Fry's carvings may be seen in many Cincinnati homes and other buildings.

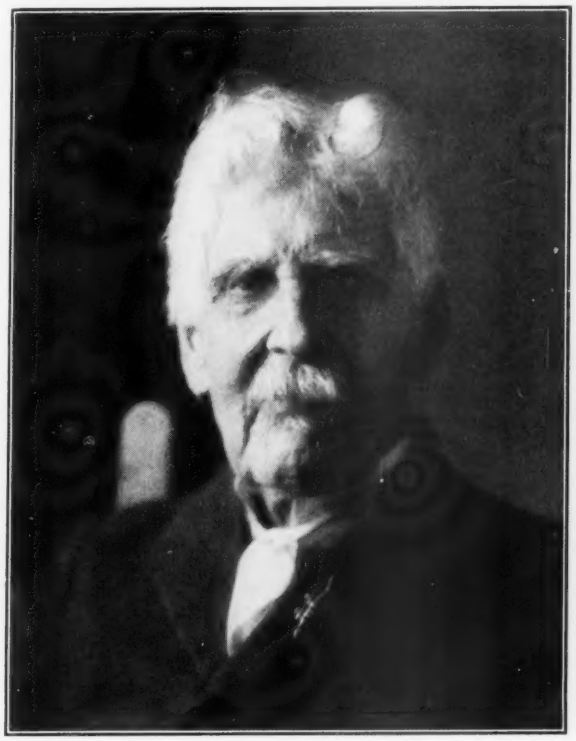
Miss Fry's art study began in Cincinnati when she was ten years old, under the direction first of Noble in drawing, then under Rebisso in modeling, and her grandfather and father in woodcarving. After years of study at home, she went to New York, working for several seasons in the Art Student's League. Later, at Trenton, N. J., she mastered the practical workings of pottery manufacture from the clay on the thrower's wheel to the finished product. After visiting the potteries of England and France, assimilating from each new experience its most helpful elements, she returned to Cincinnati where she began her career of applied art.

Few artists have won success in so many departments of study as has Miss Laura Fry, but her highest achievements have been in designing; first, for pottery decoration, second, for furniture. To her also is due the honor of placing the decoration of colors, except blue, under the glaze of Belleek or eggshell china, something which had hitherto been deemed an impossibility owing to the fragile nature of the material; and of having conceived for pottery decoration a new treatment which gave to Rookwood ware that quality of varying tones in color which made it famous in early American pottery production. Owing to her interest and early training in woodcarving, she recognized that the study of architecture was a necessity, and she undertook with brave endeavor to fathom the values of column and capital, of arch and pediment, the worth of horizontal and perpendicular lines, and the mysteries of ground plan and elevation.

Laura Anne Fry.

While in her twenties, this versatile young woman set up a studio in Cincinnati, where she was known by the fraternity of artists as ever interested in the work of her contemporaries. In her studio, she was making drawings for tables, chairs, bookcases, doing woodcarving, painting china, and producing original ideas, not copying in base reproduction the things which, though they had stood the test of time and criticism, belong to the men and ages that created them.

At this time, there was another young lady in Cincinnati some ten years older than Laura Fry who became interested in ceramics by a pottery exhibit from France at the Centennial in Philadelphia. This woman was Miss Mary Louise McLaughlin, who saw the faience made by the Havilands at Limoges and immediately began to wonder how the novel effects and exquisite colorings were accomplished. Miss McLaughlin learned something of hard-fire colors and sent to Paris to procure some. After a year or so of experimentation, she rediscovered the process of soft clay painting upon unfired ware that had the effect of oil painting. At that time, there were two potteries in Cincinnati making ironstone china and yellow clay bowls. When Miss McLaughlin saw the work-



William H. Fry.

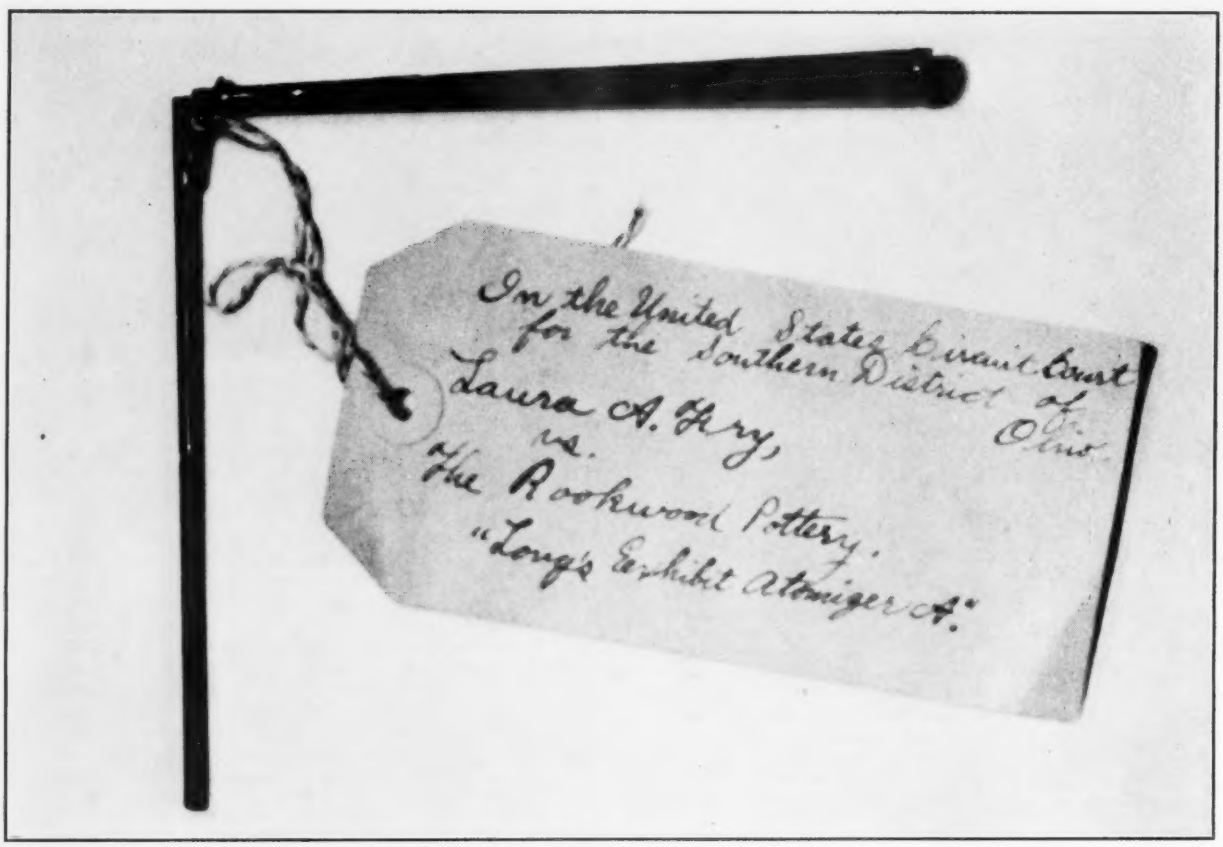
men put blue lines on a yellow bowl, she realized that her vision was practical. Her first piece was the painting of a flower on a six-inch tile. Of all persons connected with the development of artistic pottery in America, Miss Mary Louise McLaughlin deserves much credit. Her work aroused the interest of many would-be ceramic artists, among them Miss Laura Fry, whose training fitted her admirably for the part she had in the development of early American pottery.

Two years later, in 1879, Miss Laura A. Fry became a charter member of the Cincinnati Pottery Club. This was probably the first club of women organized for such a purpose in the United States. Miss McLaughlin was the President and there were some twelve other women including Laura Fry. In the first year after it was organized, the workroom of the club was in the Dallas Pottery on Hamilton Road, where, in the year 1880, was held an exhibition of the results of the first year's work. Later, the club followed the manager of this pottery, Joseph Bailey, to Rookwood Pottery, which had just been opened at what is now known as Rookwood Crossing on Eastern Avenue. During these early years of the Pottery Club, Miss Fry produced some excellent work in etched design after the Doulton method. A stoneware jug, with incised

decoration, outlined in blue, and made in 1881, is the property of the Cincinnati Art Museum. As the Rookwood pottery became established, there was less time and inclination to undertake outside work, and from force of circumstances the members of the Pottery Club were obliged to abandon the work as a group. Miss Fry became a teacher in a school of pottery painting that was attempted at Rookwood. The school, however, was a financial loss and was soon closed, at which time she became a decorator in the pottery.

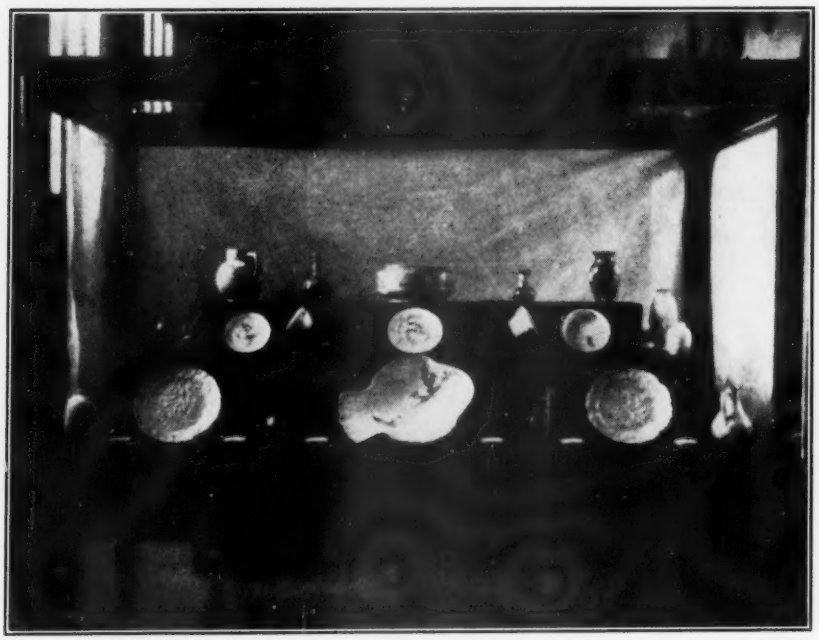
There were several decorators working in Rookwood Pottery at this time, with a Mr. Valentine as head decorator. The type of ware being made was faience, a yellow body with painted underglaze colors applied as a rule on the green ware. It was known then as soft-clay painting. Miss Fry relates that she used many methods for applying backgrounds when one day something like a voice from the air said to her, "Why not blow the color on?" She repeated this to the head decorator, "Why not blow the color on?" He replied, "It can't be done." The next day he left on his vacation. In his absence, Miss Fry tried her experiment and brought out several pieces successfully, which were exhibited in the Cincinnati Exposition. Thus she claims to be the originator of the process, which was soon adopted by every one in the decorating room. The blowing on of the color was accomplished by a simple atomizer that she had among her tools for the purpose of spraying a fixative on charcoal drawings. Very much the same sort of atomizer is still used by artists for this purpose. The accompanying photograph illustrates this atomizer which was first used by Miss Fry and was later brought into patent court by W. A. Long.

Jar with lid made by Laura Fry, 1882. (Courtesy of the City Art Museum, St. Louis.)



The atomizer first used by Laura Fry for spraying background underglaze color on pottery. This atomizer was exhibited in the U. S. Circuit Court at the time Miss Fry was seeking a patent on the atomizing process. It was exhibited by Mr. Long whose contention was that it was not a new tool or a new process insofar as the spraying of liquids was concerned.

Miss Laura Fry was employed at Rookwood as a decorator for the most part of the next ten years. During this time, she returned for one year to New York City for study, with the financial assistance of Mrs. Bellamy Storer, the owner of Rookwood. While she was in New York, her spraying process was improved by the use of compressed air. A Mr. Taylor, who was then President of Rookwood Pottery, wired Miss Fry in New York to the effect that they were seeking a patent on the process and asked for her signature for the patent right. In the meantime, a New York attorney applied for a letters patent for Miss Fry on the same process and the controversy continued for ten years. It was finally decided that the process was not patentable on the grounds that while it was a new use for an old tool, the process was not a new one. The blowing of color on pottery had been practiced by the Chinese centuries before. However unimportant the controversy, the effect of this foresight on the part of this young woman had been a far-reaching influence on the improvement of ceramic productions in this country. Soon after the showing of this ware made at Rookwood, several other potteries were using the same process. At the present time, the spraying process for underglaze colors and for the application of the glaze itself is in almost universal use in the ceramic industry.



A case containing a collection of pottery executed by Laura Fry chiefly at the Rookwood Works. (Presented by Miss Fry to the City Art Museum, St. Louis, in 1911.)

Miss Fry also had a short connection with the Lonhuda Pottery at Steubenville, Ohio, which was established before 1890. E. A. Barber, in his book entitled Pottery and Porcelain of the United States, refers briefly to this factory.

"An art pottery has recently been established in Steubenville, Ohio, for the manufacture of underglaze faience. The firm, which is known as the Lonhuda Pottery Company, is composed of Mr. W. A. Long, chemist, Mr. W. Hunter, editor of the Steubenville Daily Gazette, and Mr. Alfred Day, secretary of the U. S. Potter's Association. The shapes are simple and graceful in outline, and the decorations are the work of competent artists, among whom is Miss Laura A. Fry, formerly of Cincinnati."

The spraying of underglaze colors was employed at this plant, inasmuch as Mr. Long had formerly contended that any person was free to use the process as soon as he learned of it.

Miss Laura Fry was employed at Purdue University as Professor of Industrial Art from January 1, 1891, for one and one-half years; she returned there in 1896, and was retired June 30, 1922, on the Carnegie Foundation. At Purdue University, Miss Fry taught drawing and overglaze decoration. She was an inspiring teacher as she was devoted to her work, which has been shown by her inventiveness. She was able to direct the work through materialistic designs to the use of conventional patterns.

During the period of Miss Fry's connection with Purdue, she conducted a "China Painter's Column" for several years in *The Young Ladies Magazine*, which was published in Buffalo, N. Y. Miss Fry confessed to the writer, with a broad smile, that she was compelled to write both questions and answers for that column for several months at the beginning. She also wrote several articles for this same magazine on the subjects of design and pottery decoration.

In October, 1895, Miss Fry read a paper before the Art Congress of the Atlanta Exposition, on "American Pottery." Excerpts from this paper give us an insight as to her progressive views on art and decoration at that early date.

"It has been my privilege to visit a number of pottery workrooms; to have been identified with the beginnings of some movements and the progress of others. I find that the record of three hundred or more potteries which have existed in the United States is felt in the improvement of our wares today. What we are chiefly interested in is the present art pottery product of the country, which implies our wares and their decoration, especially the decoration.

"Where now is the woman who will give impulse to the making of home productions by setting her table with the best American porcelain? There is ware made here that is fine enough to grace the board of any queen. Still better products are sure to come.

"A painting may be ever so well executed, but be entirely out of place as a decoration, as, for instance, roses upon a jardinière. I take this opportunity to protest against flowers on a flowerpot and portraits in the middle of dinner plates. Think of eating off the portrait of a King! No article of use should be merely a background for ornament, but it should be an opportunity to enhance the value by added beauty."

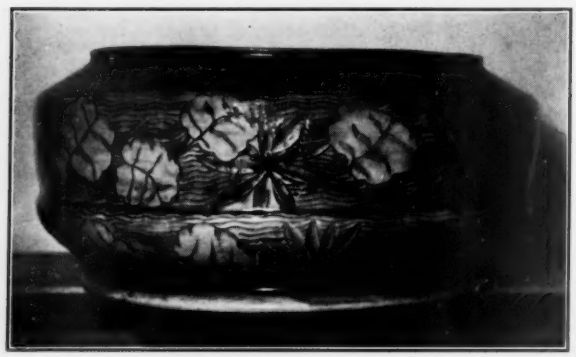
Miss Laura A. Fry has had several awards during her lifetime for her artistic achievements, and many examples of her work are to be found in more than one museum collection of fine arts. For her vision and contribution of several worth-while developments in the field of ceramics she has had but little recognition. This article is a tribute to Miss Laura A. Fry and her lifetime of unselfish devotion to experimentation in artistic pottery decoration.

Bibliography

Credit is due Ross C. Purdy, General Secretary of the American Ceramic Society, for his valuable assistance in gathering reference material for this article.

The following references were consulted and quoted in some instances:

(1) Pottery and Porcelain of the United States, by E. A. Barber, pp. 277, 283, 337.
(2) Ohio Art and Artists, by Edna Clark.
(3) "Necrology—Mrs. Bellamy Storer," *Bull. Amer. Ceram. Soc.*, **11** [6] 157–59 (1932).
(4) "History of Rookwood Pottery," *ibid.*, **15** [12] 443–45 (1936).



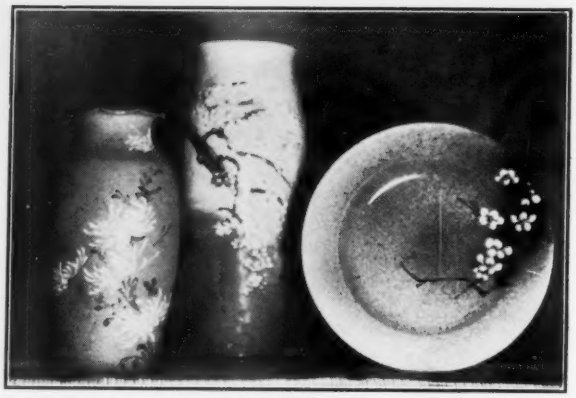
Carved clay bowl by Laura Fry, Cincinnati Pottery Club, 1885. (Courtesy of the City Art Museum, St. Louis.)

(5) "Mary Louise McLaughlin," *ibid.*, **17** [5] 217–25 (1938).
(6) "History of the Clay Industry in Ohio," by Stout, Stull, McCaughey, and Demorest, *Bull. Geol. Surv. Ohio*, No. 26.
(7) Cincinnati Artists File, Cincinnati Art Museum.
(8) Mary Burroughs, "Some Successful Women Artists," *The Young Ladies Mag.*, **2** [No. 4] 1896.
(9) *The Cincinnati Post*, December 26, 1929.
(10) *The Cincinnati Times Star*, December 26, 1929.
(11) Letters from Mary Louise McLaughlin, Cincinnati, Ohio; The City Art Museum, St. Louis, Mo.; Purdue University, Lafayette, Ind.; Mr. H. H. Fry, Camp Dennison, Ohio; Mrs. Lillie Fry Fisher, Cincinnati, Ohio; and the Cincinnati Art Museum, Cincinnati, Ohio.

The following is a list of examples of pottery by Miss Laura A. Fry in the permanent collection of the Cincinnati Art Museum, Cincinnati, Ohio: *Pitcher, 1881:* gray ground with blue incised line design of flowers and ducks and marked "Cincinnati Pottery Club" ($8^3/_4$ in. high); *jug, 1882:* green-gray glaze with incised apple blossoms (8 in. high); and *tray, 1896:* blue overglaze decoration of wreath of fruit and white blossoms.

The following is a list of examples of pottery by Miss Fry in the permanent collection of The City Art Museum of St. Louis, St. Louis, Mo.:

(1) First piece done by Miss Fry; (2) 1879: pilgrim vase, painted in the green clay; bottle, mat blue painted on green clay; (3) 1880: three plates fired at Scott's Pottery; (4) 1881: plaque, clay painting; sugar and cream, semiglaze; small pitcher, old stamp; (5) 1882: whiskey bottle, clay painting; pitcher, clay painting, semiglaze; jar, biscuit painting; vase, biscuit painting; pitcher, carved in soft clay, olive glaze; pitcher, carved in sage-green clay, silver top; carved plate, original; carved plate, cast from model carved by Miss Fry; (6) 1885: turkey platter, fish platter, and meat platter, style of tableware made by Rookwood at this time and long since discontinued; six individual butter plates; cup and saucer; and carved clay bowl, Cincinnati Pottery Club (sage-green colored with cobalt blue).



Pottery executed by Laura Fry at Rookwood in 1885. The plate is made of a white body and the background color (blue) was sprayed on. (From the collection of H. H. Fry, Camp Dennison, Ohio.)

Pieces from Rookwood: Three teapots; tea caddy; porcelain cup; small bronze vase; sponged ground; pitcher, design cut through sprayed color; jug, semiglaze, red clay hard fire; jug, blue glaze on white clay; and dish with printed design from a copper-plate etching.

6926 Willow Street
New Orleans, Louisiana

NATIONAL CERAMIC ASSOCIATION FOUNDED 1891*

This Association was organized in 1891 with local section units and a monthly publication edited by Miss Mary Louise McLaughlin.

Ten thousand women are actively engaged in the United States in the modeling or decoration of pottery. Five thousand earn a living by china painting. The fact that 1000 pottery decorators dwell in the vicinity of Chicago led last February to the organization in that city of the National Ceramic Association.

Miss Louise McLaughlin, the discoverer of underglaze painting in this country, is the president, while Mrs. Benjamin Harrison is first vice-president, and Miss Mary J. Lyster, secretary.

The object of the association is to advance the art and secure the finest possible exhibit at the World's Fair. Porcelain, as a medium of expressing to posterity the artistic feeling of an age, is in certain lines incomparable.

American ceramics, as now understood, are an outgrowth of the Centennial of 1876. Consider the art development of the past sixteen years, and well may we wait impatiently the revelations the World's Fair has in store! Scarcely a town in the United States from 10,000 to 30,000 inhabitants is now without an art school, some scarcely inferior to those of the Old World, while our potteries rival well-known European ware.

To the exhibit at Philadelphia, in 1876, by that pioneer band of Cincinnati decorators—Misses Louise M. McLaughlin, Clara Newton, Laura Fry, and Alice Holabird—and the Japanese ceramic display, which suggested to the fertile genius of the brilliantly versatile Maria Longworth Storer the artistic possibilities of the clays of her native Missouri valley, America is largely indebted for its present prominence in the ceramic world. Connoisseurs at home and abroad concede that in the Rookwood pottery America has achieved its first and only distinctive artistic creation.

This successful utilization of native clays, together with Miss McLaughlin's discovery of underglaze painting and the publication of her treatise on the subject, gave an impetus to pottery decoration that has widened with the years, making the organization of a national association almost imperative.

*Article from a Cincinnati, Ohio, newspaper, 1891.

Amateurs—that is, any persons who have not served a professional apprenticeship—are eligible to membership. They may appear as individuals or as societies. Membership is not confined to women. Several men have already enrolled. Twenty-six states and two territories are entered to date, and applications are daily received from unexpected sources—mining camps, mountain reservations, and outlying army posts, where artistic instinct is finding an outlet and ennui an enemy in the fascinating mysteries of minerals and a kiln. Fifteen thousand square feet of space has been secured in the building of Liberal Arts. The National Association exhibits as an industry, not as a sex. Specimen work, however, will be sent to the Women's Building.

Chicago is the most active center of this ceramic development. It has two flourishing organizations—the Chicago and the Columbian Ceramic societies.

The annual exhibits of the Chicago clubs attract artists from all parts of the United States. Cincinnati, Philadelphia, Boston, and New York follow Chicago in ceramic activity. The finest china painting is done in Nebraska. It is the hope of the instigators of the present movement that a purely national school of ceramics will be the outgrowth of the national association.

A better president—one who has more at heart the advancement of the art—than Miss McLaughlin could hardly have been chosen. In her beautiful home at Walnut Hills, Cincinnati, she has her studio. Exquisite specimens of her skill in underglaze and overglaze effects, with etching on copper and various original metallic conceits in form and color, are to be seen these days, for Miss McLaughlin is busily preparing for an exhibit of her work to be held at Goupil's, in New York City, in November.

It was while watching the potters put blue bands on common yellow clay flowerpots in a pottery in Cincinnati that Miss McLaughlin conceived the idea of securing underglaze effects in color by mixing dry mineral paints with the raw clay. This was in 1878, and the first piece of underglaze decorated pottery made in this country is now in Miss McLaughlin's study—a homely little blue vase, modeled by a pottery worker. Miss McLaughlin decorated it in apple blossoms in bold relief.

The National Ceramic Association, generously supported, will tend to disseminate correct and practical information, so that many of the disappointments awaiting those who essay the work at a distance from competent instruction may be avoided.

A dollar and a half covers the member's initiation fee and annual dues. With this money, the Association proposes to publish for distribution among the members the papers that will be read at the monthly meetings; lectures by those conversant with the potter's art in this and other lands; treatment of certain colors peculiar in their working; valuable hints and suggestions in regard to the various ware; merits of different kilns for amateur firing—all given by experts—will thus reach the remotest member.

A national ceramic school can not fail to be established. With its growth, the necessity of sending American women abroad to study the fascinating art will be obviated.

—Lida Rose McCabe

A PART OF MY EXPERIENCE IN THE POTTERY BUSINESS AND MY FATHER'S EXPERIENCE

By William J. Gordy

My father was born in what is called Jugtown, Ga., near Thomaston, Ga. He was not born in the pottery business. However, he worked around the pottery at different times. He had uncles and cousins who had been making pottery for years. Back in those days, they made churns, jugs, pitchers, and crocks mostly.

Georgia Art Pottery.

A few years before I was born, my father went into the brick business. He made brick for a number of years. I was born back in 1910; he was making brick at that time. He went to making pottery in the fall of 1910 and quit making brick. He built his pottery plant at Alvaton, Ga., in Meriwether County. That is where I learned the trade. He made mostly handmade stoneware glazed with Albany slip and bristol white for a number of years before he began making art pottery. My father learned to throw but wasn't very fast and could not make anything larger than a four- or five-gallon capacity.

I started throwing when I was very young. I had a potter's wheel to learn on when I was just thirteen years

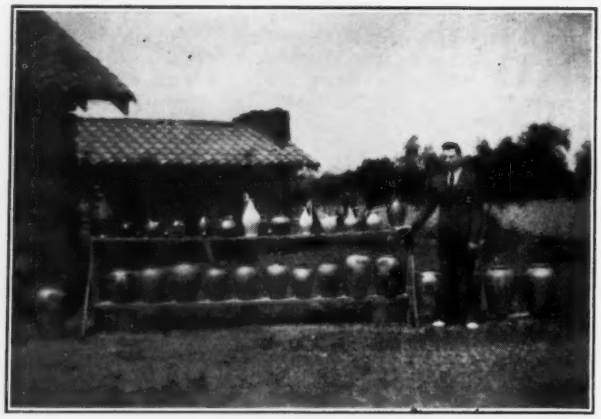
William J. Gordy at the wheel.

of age. I practiced on it steady for five years. The first two, I practiced on flowerpots. After school hours right to the wheel I would go and on Saturdays. I learned to throw stoneware before I began learning artware. The stoneware trade got slow and artware was a better demand, and I put most of my time at making it.

In the meantime, I was helping to glaze and fire kilns, getting all the experience I could. I did not know much about making glazes. I decided to travel a while and work in different art potteries. So I traveled and worked in a number of shops for over five years and learned to make different shapes and better ones. Also I received a lot of information on making glazes.

I thought it was time for me to go in business myself, and I came back to Georgia and settled on Highway U. S. 41, five miles north of Cartersville, Ga., and am now operating the Georgia Art Pottery, making all handmade artistic pottery, hardfired and waterproof. Visitors are cordially welcomed at any time.

Most of my pottery is fired in saggers. I make them myself by hand. I use cones to register my heat temperature, use a downdraft kiln, and fire with pine wood. It takes about twenty-six hours to fire the kiln, and then about seventy-two hours to cool before taking out the pottery. The ware is all fired two times, biscuit fire and gloss fire.



William J. Gordy.

This is about all I have to tell in writing, but visitors can see and hear more about the Georgia Art Pottery after coming here.

ACTIVITIES OF THE SOCIETY

NEW MEMBERS

Personal

HALL, JOHN T., Park Blvd., East Liverpool, Ohio; superintendent, Hall China Co.

HAYMAN, JAMES C., 128, Tan-Y-Groes St., Port Talbot, Glamorgan, South Wales, Great Britain; refractories technologist, Messrs. Guest, Keen & Baldwins I. & S. Co., Ltd.

JACKSON, A. CURTIS, 381 Maplewood Ave., Columbus, Ohio; ceramist, Claycraft Co.

JEROME, ALAN J., Toledo Scale Co., 3216 Monroe St., Toledo, Ohio; assistant manager industrial sales.

SIMON, A. G., Pickard Co., Antioch, Ill.; manager of plant.

TETZNER, ALEXANDER R., Vienna XIII T66, Hadikgane, Germany; ceramic engineer, Wm. Email & Glasurfarbwerk Schauer & Co.

WALSH, N. S. C., 4228 North First St., St. Louis, Mo., president, Walsh Refractories Corp.

WHEATON, FRANK H., JR., 1118 North High St., Millville, N. J.; T. C. Wheaton Co.

Student

CHILCOTE, JOSEPH H., 1836 West 5th Ave., Columbus, Ohio (Ohio State Univ.)

GOIN, FRED L., 274 Parkview Terrace, Oakland, Calif. (Univ. of Washington)

HAMMELL, RICHARD H., 19 East St., Nunda, N. Y. (N. Y. State Coll. of Ceramics)

HELZ, ARMIN W., 2402 North 38th St., Milwaukee, Wis. (Rutgers Univ.)

MEMBERSHIP WORKERS' RECORD

Personal

F. E. Bardrof	1	J. T. Ogden	2
L. H. Brown	2	C. F. Tefft	1
A. E. Dodd	1	Office	1

Student

V. V. Kelsey	3	H. Z. Schofield	1
		Grand Total	**12**

RESOLUTIONS IN APPRECIATION OF WILLARD D. RICHARDSON BY BOARD OF TRUSTEES

For forty years Willard D. Richardson gave freely of his time and talents to the American Ceramic Society. He was a Charter Member and served as Vice-President and later as President. Annually he contributed papers at the Meetings. He served with diligence on several committees. For a period of five years, he served with meager compensation as Editor of *The Transactions*. He was ever a source of information and inspiration in private chats and in Meeting discussions.

On July 18, 1938, Willard passed away. He has departed from us only in a physical sense. Willard will never be separated from the ceramists the world over because, by his inventions, writings, and activities, he will continue to influence and to inspire.

We, as members of the Board of Trustees of the American Ceramic Society, by these Resolutions, wish to convey to Mrs. Richardson and her three daughters, Isabel, Josephine, and Jane, the fact that we share in their bereavement because of his physical passing and share with them a high esteem of his rich and permanent name which is ours to enjoy for all time.

For the Board of Trustees,

V. V. KELSEY, *President*
R. C. PURDY, *General Secretary*

ANNOUNCEMENT TO APPLICANTS FOR MEMBER GRADE IN THE INSTITUTE OF CERAMIC ENGINEERS

Owing to delays in reaching an agreement on the character and procedure of the examination specified in the Rules of the Institute, for those not holding a professional engineer's license, no such examination will be given during the current year. Applicants otherwise qualified are urged to apply for Associate Member grade until this matter is settled.

—ARTHUR S. WATTS, *Chairman*
Committee on Membership and Examinations

SCHEDULE OF MEETINGS

THE AMERICAN CERAMIC SOCIETY

I. FORTY-FIRST ANNUAL MEETING, STEVENS HOTEL, CHICAGO, ILL., APRIL 16–22, 1939

II. GENERAL AUTUMN MEETING, SAN FRANCISCO, CALIF., AUGUST 6–12, 1939

III. ART DIVISION
- (1) Dearborn Inn, Dearborn, Mich., October 24–25, 1938
- (2) Seventh National Ceramic Exhibition, Syracuse, N. Y., October 27–November 21, 1938
- (3) Carnegie Museum, Pittsburgh, Pa., January, 1939

IV. WHITE WARES AND MATERIALS AND EQUIPMENT DIVISIONS
Bedford Springs Hotel, Bedford, Pa., September 15–17, 1938

PORCELAIN ENAMEL INSTITUTE FORUM

Third Annual Meeting, Urbana, Ill., October 12–14, 1938

OHIO CERAMIC INDUSTRIES ASSOCIATION

Columbus, Ohio, October 7–8, 1938

A.I.M.M.E. MINERALS DIVISION

Knoxville, Tenn., October 6–8, 1938
Los Angeles, Calif., October 20–21, 1938

INTERNATIONAL GLASS CONGRESS

Berlin and Munich, Germany, July 6–15, 1939

Read *The Bulletin of the American Ceramic Society* for detailed information on these meetings

Issued the 15th day of each month

THE AMERICAN CERAMIC SOCIETY

2525 North High Street, Columbus, Ohio

UP AND UP GOES
Registration of Paid Members

Note that decrease in number of "Deferred" payments. Opportunity to pay "at later date" or in "installments" is honored.

Only *eleven Personals* and *six Corporations* are needed to bring the totals back to the January high, thus making up for all "resignations" and "cut-offs."

The August total of members plus subscribers exceeds the January total by fifty-eight. "Yep," this is meritorious but—*eleven more Personal* and *six more Corporations*, please.

Members joining mid-calendar year may do so by paying the portion of dues necessary to cover the remaining months. Membership records are for the calendar year.

PAID MEMBERSHIP RECORD

Date of Record	Members Paid		Deferred	Subscriptions	Monthly Sales	Total Circulation
	Personal	Corporation				
December 20, 1936	1452	196				
December 22, 1937	1713	220	12	523	220	2688
January 22, 1938	1712	220	12	530	220	2694
February 18, 1938	1728	217	15	540	220	2720
March 18, 1938	1770	216	10	513	220	2729
April 18, 1938	1635	205	60	527	220	2647
May 19, 1938	1643	208	52	548	220	2671
June 21, 1938	1675	210	49	563	220	2717
July 19, 1938	1687	212	41	573	220	2733
August 19, 1938	1701	214	37	574	220	2746

ROSTER OF CORPORATION MEMBERS

Abbé Engineering Co., New York, N. Y.
Abingdon Sanitary Mfg. Co., Abingdon, Ill.
A C Spark Plug Co., Flint, Mich.
Akron Porcelain Co., Akron, Ohio
Aluminum Ore Co., East St. Louis, Ill.
American Gas Assn., New York, N. Y.
American Lava Corp., Chattanooga, Tenn.
American Nepheline Corp., Rochester, N. Y.
American Potash & Chemical Corp., New York, N. Y.
American Refractories Institute, Pittsburgh, Pa.
American Rolling Mill Co., Middletown, Ohio
American Sheet & Tin Plate Co., Pittsburgh, Pa.
American Stove Company, St. Louis, Mo.
Amsler-Morton Co., Pittsburgh, Pa.
Arketex Ceramic Corp., Brazil, Ind.
Atlantic Terra Cotta Co., Perth Amboy, N. J.

Babcock & Wilcox Co., New York, N. Y.
Ball Brothers Co., Muncie, Ind.
Baltimore Enamel & Novelty Co., Baltimore, Md.
Bausch & Lomb Optical Co., Rochester, N. Y.
Binghamton Brick Co., Inc., Binghamton, N. Y.
Blythe Colour Works, Ltd., Cresswell, Stoke-on-Trent, England
Bonnot Company, Canton, Ohio
Brockway Glass Company, Inc., Brockway, Pa.
Buck Glass Company, Baltimore, Md.
Buffalo Pottery, Buffalo, N. Y.

Canadian General Electric Co., Ltd., Peterborough, Ontario, Canada
Canton Stamping & Enameling Co., Canton, Ohio
Carborundum Company, Niagara Falls, N. Y.
Carr-Lowrey Glass Co., Baltimore, Md.
Celo Mines, Inc., Burnsville, N. C.
Central Silica Company, Glenford, Ohio
Ceramic Color & Chemical Mfg. Co., New Brighton, Pa.
Certain-Teed Products Corp., Buffalo, N. Y.
Champion Spark Plug Co., Detroit, Mich.
Chattanooga Glass Co., Chattanooga, Tenn.
Chicago Hardware Foundry Co., North Chicago, Ill.
Chicago Pottery Co., Chicago, Ill.
Chicago Vitreous Enamel Product Co., Cicero, Ill.
Clark, N., & Sons, San Francisco, Calif.
Clay Products Association, Chicago, Ill.
Coors Porcelain Company, Golden, Colo.
Corhart Refractories Co., Inc., Louisville, Ky.
Corning Glass Works, Corning, N. Y.
Corning Glass Works, Macbeth-Evans Div., Charleroi, Pa.
Cortland Grinding Wheels Co., Chester, Mass.
Crane Enamelware Company, Chattanooga, Tenn.
Crooksville China Co., Crooksville, Ohio
Crossley Machine Co., Trenton, N. J.
Crossman Company, South Amboy, N. J.
Crown Potteries Co., Evansville, Ind.

Detroit Electric Furnace Co., Detroit, Mich.
DeVilbiss Co., Toledo, Ohio
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Drakenfeld, B. F., & Co., New York, N. Y.
Du Pont de Nemours, E. I., & Co., R. & H. Chemical Dept., Wilmington, Del.

Edgar Plastic Kaolin Co., Metuchen, N. J.
Electro Refractories & Alloys Corp., Buffalo, N. Y.
Engelhard, Charles, Inc., Newark, N. J.
English China Clays Sales Corp., New York, N. Y.
Eureka Flint & Spar Co., Trenton, N. J.
Exolon Company, Blasdell, N. Y.

Federal Seaboard Terra Cotta Corp., Perth Amboy, N. J.
Ferro Enamel Corp., Cleveland, Ohio
Findlay Clay Products Co., Washington, Pa.
Fostoria Glass Co., Moundsville, W. Va.
Frazier-Simplex, Inc., Washington, Pa.

Gayner Glass Works, Salem, N. J.
General Ceramics Co., New York, N. Y.
George, W. S., Pottery Co., East Palestine, Ohio
"Giesche" Fabryka Porcelany Sp. Akc., Katowice-Bogucice, Poland
Gillinder Brothers, Inc., Port Jervis, N. Y.
Gladding, McBean & Co., Lincoln, Placer County, Calif.
Gleason-Tiebout Glass Co., Maspeth, N. Y.
Glenwood Range Co., Taunton, Mass.
Grammes, L. F., & Sons, Inc., Allentown, Pa.
Great Lakes Foundry Sand Co., Detroit, Mich.
Great Lakes Steel Corp., Detroit, Mich.
Green, A. P., Fire Brick Co., Mexico, Mo.

Haeger Potteries, Inc., Dundee, Ill.
Hall China Company, East Liverpool, Ohio
Hanley Company, Summerville, Pa.
Hanovia Chemical & Mfg. Co., Newark, N. J.
Hardinge Company, Inc., York, Pa.
Harshaw Chemical Co., Cleveland, Ohio
Hartford-Empire Co., Hartford, Conn.
Hazel-Atlas Glass Co., Zanesville, Ohio
Hocking Glass Co., Lancaster, Ohio
Hommel, O., Co., Pittsburgh, Pa.
Houze, L. J., Convex Glass Co., Point Marion, Pa.

Illinois Clay Products Co., Joliet, Ill.
Ingram-Richardson Mfg. Company of Indiana, Inc., Frankfort, Ind.
International Smelting & Refining Co., East Chicago, Ind.
Irish Glass Bottle Co., Ltd., Dublin, Ireland
Ironton Fire Brick Co., Ironton, Ohio
Isolantite, Incorporated, Belleville, N. J.

Kaolin, Incorporated, Spruce Pine, N. C.
Kentucky Clay Mining Co., Mayfield, Ky.
Kentucky-Tennessee Clay Co., Mayfield, Ky.
Knowles, Edwin M., China Co., Newell, W. Va.
Kohler Company, Kohler, Wis.
Koppers Construction Co., Pittsburgh, Pa.
Kraftile Company, Niles, Calif.

Laclede-Christy Clay Products Co., St. Louis, Mo.
Lancaster Iron Works, Lancaster, Pa.
Lapp Insulator Co., Inc., Le Roy, N. Y.
Laughlin, Homer, China Co., Newell, W. Va.
Lava Crucible Co. of Pittsburgh, Pittsburgh, Pa.
Lee Clay Products Company, Clearfield, Ky.
Libbey Glass Company, Toledo, Ohio
Lindemann, A. J., & Hoverson Co., Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
London Brick Co., Ltd., London, England
Louthan Manufacturing Co., Ltd., East Liverpool, Ohio
Lynch Corporation, Anderson, Ind.
Lynch, A. J., & Co., Los Angeles, Calif.

Maryland Glass Corp., Baltimore, Md.
Mason City Brick & Tile Co., Mason City, Iowa
McHose, L. H., Inc., Perth Amboy, N. J.
McKee, Arthur G., & Co., Cleveland, Ohio
Metal & Thermit Corp., New York, N. Y.
Mississippi Glass Co., New York, N. Y.
Mitchell Clay Mfg. Co., St. Louis, Mo.
Moore & Munger, New York, N. Y.
Mosaic Tile Company, Zanesville, Ohio
Mt. Clemens Pottery Co., Mt. Clemens, Mich.

National Engineering Co., Chicago, Ill.
National Fireproofing Corp., Pittsburgh, Pa.

National Industrial Sand Assn., Washington, D. C.
National Lime and Stone Co., Findlay, Ohio
Newbold Silica Fire-Brick Co., Ltd., Sydney, N.S.W., Australia
New Castle Refractories Co., New Castle, Pa.
New Jersey Porcelain Co., Trenton, N. J.
New Jersey Pulverizing Co., New York, N. Y.
Nippon Gaishi Kabushiki Kaisha, Nagoya, Japan
Nippon Toki Kaisha, Ltd., Nagoya, Japan
North American Refractories Co., Cleveland, Ohio
North Carolina Feldspar Corp., Erwin, Tenn.
Norton Company, Worcester, Mass.

Ohio Insulator Company Div., Ohio Brass Co., Barberton, Ohio
Onondaga Pottery Co., Syracuse, N. Y.
Orton, Edward, Jr., Ceramic Foundation, Columbus, Ohio
Owens-Illinois Glass Co., Alton, Ill.
Owens-Illinois Pacific Coast Co., San Francisco, Calif.

Pacific Clay Products, Los Angeles, Calif.
Paper Makers Importing Co., Inc., Easton, Pa.
Pass & Seymour, Inc., Solvay, N. Y.
Pennsylvania Pulverizing Co., Lewistown, Pa.
Pennsylvania Salt Mfg. Co., Philadelphia, Pa.
Pfaudler Company, Rochester, N. Y.
Pittsburgh Plate Glass Co., Creighton, Pa.
Porcelain Enamel & Mfg. Co., Baltimore, Md.
Portsmouth Clay Products Co., Portsmouth, Ohio
Potters Supply Co., East Liverpool, Ohio
Precision Grinding Wheel Co., Philadelphia, Pa.

Quigley Company, Inc., New York, N. Y.

Ransome Concrete Machinery Co., Dunellen, N. J.
Republic Steel Corp., Youngstown, Ohio
Rickmann & Rappe, Koln-Kalk, Germany
Riddell, W. A., Co., Bucyrus, Ohio
Rochester & Pittsburgh Coal Co., Indiana, Pa.
Roseville Pottery Co., Zanesville, Ohio
Ross-Tacony Crucible Co., Philadelphia, Pa.
Rundle Manufacturing Co., Milwaukee, Wis.
Rustless Iron Co., Ltd., Keighley, England

Safety Grinding Wheel & Machine Co., Springfield, Ohio
Salem China Company, Salem, Ohio
San Miguel Brewery, Inc., Manila, P. I.
Sebring Pottery Company, Sebring, Ohio
Shenango Pottery Company, New Castle, Pa.
Simonds Worden White Co., Dayton, Ohio
Smith & Stone, Ltd., Georgetown, Ontario, Canada
Solar Laboratories, Beaver, Pa.
Solvay Process Company, Syracuse, N. Y.
Southern California Gas Co., Los Angeles, Calif.
Spinks, H. C., Clay Co., Newport, Ky.
Square D Company, Detroit, Mich.
Standard Sanitary Mfg. Co., Louisville, Ky.
Star Porcelain Co., Trenton, N. J.
Stark Ceramics, Inc., Canton, Ohio
Steele, J. C., & Sons, Statesville, N. C.
Sterling Grinding Wheel Co., Tiffin, Ohio
Summitville Face Brick Co., Summitville, Ohio
Sur Enamel & Stamping Works, Ltd., Calcutta, India
Swindell Brothers, Baltimore, Md.
Swindell-Dressler Corp., Pittsburgh, Pa.

Taylor, Smith, & Taylor Co., Chester, W. Va.
Toyo Toki Kwaisha, Kokura City, Japan
Trenton Potteries, Trenton, N. J.
Twyfords, Limited, Stoke-on-Trent, England
Tyler, W. S., Company, Cleveland, Ohio

Union Electrical Porcelain Works, Trenton, N. J.
Union Française des Produits Refractaires, Paris, France
United Clay Mines Corp., Trenton, N. J.
United Glass Bottle Mfrs., Ltd., London, England
United States Gypsum Co., Chicago, Ill.
Universal Clay Products Co., Sandusky, Ohio
Universal Dental Co., Philadelphia, Pa.
Universal Sanitary Mfg. Co., New Castle, Pa.

Verreries Souchon Neuvesel, Lyon, France
Vesuvius Crucible Co., Swissvale, Pa.
Victor Insulators, Inc., Victor, N. Y.
Vitrefrax Corporation, Los Angeles, Calif.
Vitreous Steel Products Co., Cleveland, Ohio
Vitro Manufacturing Co., Pittsburgh, Pa.
Vollrath Company, Sheboygan, Wis.

Wallace China Co., Ltd., Huntington Park, Calif.
Waltham Grinding Wheel Co., Waltham, Mass.
Wayne Laboratories, Waynesboro, Pa.
Western Brick Co., Danville, Ill.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Derry, Pa.
Wheeling Steel Corp., Portsmouth, Ohio
Whitall-Tatum Co., Millville, N. J.

ROSTER CHANGES DURING AUGUST*

Personal

CARTWRIGHT, VANCE S., 621 New Court, Youngstown, Ohio (Niles, Ohio)
DIETRICH, WALDEMAR F., 626 North El Canimo Real, San Mateo, Calif. (Sacramento, Calif.)
FAUST, GEORGE T., 18 Audubon Place, Tuscaloosa, Ala. (New Brunswick, N. J.)
FLINT, FRANCIS C., Hazel-Atlas Glass Co., 319 South Main St., Washington, Pa. (Zanesville, Ohio)
GOULD, ROBERT E., Box 395, Eden, N. Y. (Norris, Tenn.)
GRIFFITH, RULON L., 524 Bingaman St., Reading, Pa. (Claysburg, Pa.)
HOTTINGER, A. F., Green Bay Drop Forge Co., Green Bay, Wis. (Chicago, Ill.)
KELSEY, V. V., Dominion Minerals, Inc., 719–15th St., N. W., Washington, D. C. (Trenton, N. J.)
MAUPIN, ADDISON, General Refractories Co., West Decatur, Pa. (Raleigh, N. C.)
NEWHOUSE, HENRY, 110 Maryland Ave., N. E., Apt. 402, Washington, D. C. (Columbus, Ohio)
PUTNEY, MRS. EDMONDS, Easy St., Nantucket, Mass. (New York, N. Y.)
SANBORN, PAUL., 107 Fifth Ave., Huntington, W. Va. (Kenova, W. Va.)
SCHROEDER, FRED W., 926 W. Love St., Mexico, Mo. (Pittsburgh, Pa.)
SMOOT, JACK M., Box 174, Decatur, Ga. (Carr's Station, Ga.)
SUMRELL, FERRALL N., 89–38 196th St., Hollis, N. Y. (Brooklyn, N. Y.)
STAMEY, ROBERT B., Soil Conservation Service, Graceville, Fla. (Greensboro, N. C.)
THORLEY, JOSEPH P., Parkway, East Liverpool, Ohio. (Richmond, Va.)
WILSON, HEWITT, T.V.A. Ceramic Lab., U. S. Bureau of Mines, Norris, Tenn. (Seattle, Wash.)

Student

FOOTE, E. H., JR., Akron Rd., Medina, Ohio. (Va. Polytechnic Inst.)
HAFF, ROBERT S., JR., Box 90, West Frankfort, Ill. (Va. Polytechnic Inst.)
LULL, STANLEY, Prospect Rd., Westfield, N. Y. (Ohio State Univ.)
MAURER, JAMES A., 2514 E. Beverly Rd., Milwaukee, Wis. (Univ. of Ill.)
SPIEGEL, PHILIP, 67 Lakeview Ave., Lynbrook, N. Y. (N. Y. State Coll. of Ceramics)
VADHANA, SUVAN T., 2300 Kalorama Rd., Washington, D. C. (Univ. of Michigan)

* Address in parentheses is the former address.

WALTER JAMES REES VISITS THE UNITED STATES

Members of the American Ceramic Society have had the pleasure of entertaining Dr. and Mrs. Walter J. Rees during the past month. Dr. Rees attended and was one of the speakers at the Refractories Division meeting at Bedford Springs, Pa.

Walter James Rees was born in Buckinghamshire, England, in 1879. His father was Welsh and his mother was English. He was educated in the primary and technical schools in Birmingham; at Mason College, Birmingham; and the Royal College of Science, London.

From 1901 to 1906 he was chief assistant chemist to Chance Brothers and Co., Ltd., glass manufacturers, Smethwick; 1906 to 1917, chief chemist to Chance Bros.; 1918 to present time, in charge of the Department of Refractory Materials, University of Sheffield. In 1932, Dr. Rees received the Beilby Memorial Award of the Society of Chemical Industry, the Institute of Chemistry, and the Institute of Metals, for continued meritorious research. In 1935, he was made a Freeman of the Sheffield Trades Technical Societies for services rendered in the promotion of clay and refractories technology.

Dr. Rees is a Master of Technical Science; Fellow, Institute of Chemistry; Fellow, Society of Glass Technology; member, American Ceramic Society; the British Ceramic Society (member of Council and past vice-president); the Society of Chemical Industry; the Iron and Steel Institute (chairman of Molding Materials Research Sub-Committee); the British Refractories Research Assn.; the Institute of British Foundrymen (chairman of the Refractories Committee); the National Assn. of Clayworks' Managers (vice-president); the Refractories Assn. of Great Britain (secretary, 1920–1936; president, 1936–37–38; at the present time, secretary); Society of Public Analysts; Honorary Member of the British Cast Iron Research Assn.

Dr. Rees is author of numerous research papers since 1901 in the *Transactions of the Ceramic Society;* the Society of Glass Technology; the Society of Chemical Industry; the British Refractories Research Assn.; the Institute of British Foundrymen; and the Royal Society of Art. In May, 1938, he presented the Exchange Paper on "Silica Refractories for the Cupola" to the American Foundrymen's Association.

His side interests and hobbies are gardening, especially Alpine gardening; golf (in the "rabbit" class); music (secretary, Sheffield University Musical Society and member of Committee of Sheffield Philharmonic Society); photography; collecting old glass and pottery; Freemasonry, past-master of Keramos Lodge No. 4967, United Grand Lodge of England, and of Sheffield University Lodge No. 3911.

W. J. Rees

LETTERS TO THE EDITOR

INTER-SOCIETY COLOR COUNCIL

August 1, 1938

Dear Mr. Purdy:

I am gratified to learn from your letter of July 25 that the American Ceramic Society is to become affiliated with the Council as its tenth member body.

It is a pleasure to give you further information about the Council; this information will be documented and amplified by material which will come to your office as Secretary of a member body.

The folder, "What Is the Inter-Society Color Council," states the purpose, "to stimulate and coördinate the work being done by various societies and associations leading to the standardization, description, and specification of color and to promote the practical application of these results to the color problems arising in science, art, and industry." How this work of stimulation, coördination, and promotion is to be carried out is a question which the various successive executive committees have answered differently. Some of the earlier efforts to carry out the stated purposes have, in my opinion, come to little; others have borne fruit. During the last three years, however, substantial unanimity of opinion has been reached so that it is possible to predict with some reliability what is likely to concern the Council in the next few years. I shall mention some of the successful projects as evidence of how the Council works and also two of the problems which I believe will come before the Council soon. These two problems concern the American Ceramic Society more than some others in prospect.

What the Council Has Done

(*1*) *Color Names:* The U. S. Pharmacopœial Revision Committee asked the Council in 1931 to develop "a means of designating colors in the U. S. Pharmacopœia, in the National Formulary, and in general pharmaceutical literature; such designation to be sufficiently standardized as to be acceptable to science, sufficiently broad to be appreciated and usable by science, art, and industry, and sufficiently commonplace to be understood, at least in a general way, by the whole public." They required not only a system of color names but also a means of selecting a system of working standards for its application which would not open the Committee to the criticism of favoring

one private concern over another. By 1932 the general plan of a system of color names had been worked out in the Council. Further details were added in 1933 and 1934. In 1937, the color names selected in committee were approved by the Council, and in 1938 a plan for review of the final details was approved. This plan is now being put into effect, and it is expected that a final revision of the system will be approved at the 1939 Annual Meeting. The tentative system is already being used by the U. S. Pharmacopœial Revision Committee. The Council thus obtained for one of its member bodies the advice of the color experts of two other member bodies (the Optical Society of America and the American Psychological Association); it obtained for this member body the coöperation of the National Bureau of Standards which had previously been sought and refused; and the Council served as an authoritative source of information not swayed by commercial considerations for deciding which of the various competing systems of material color standards was best suited to derivation of the color names. In all of this work, the allied interests of another member body (the Textile Color Card Association of America) were protected by the presence of its delegates at the Council meetings.

(*2*) *Designation of Gelatins for Stage Illumination:* At the request of a member body (the Illuminating Engineering Society), there has been worked out a method which seems to be adequate and also simple and practical. This method will be submitted to the Council delegates for approval by letter ballot this fall. In this case, the Council gave its joint advice at two annual meetings and secured the interest and services of a delegate from another member body (the Optical Society of America).

(*3*) *Who's Who in Color:* A reference list of about 250 persons who are recognized as authorities in their particular branches of color work (scientific, technical, educational, and industrial) has been compiled, published, and circulated to Council delegates. (A copy of this list will be sent to you.) It contains not only the names and addresses of these persons, but also other information such as chief color interest, nature of the color work, education, and publications. All of the member bodies coöperated in collecting this information.

(*4*) *Survey of Color Terms:* This survey has been completed by five of the nine member bodies; surveys by three of the remaining member bodies are expected to be completed during this year. The survey has revealed many color terms generally known only within one member body and many instances in which the same term is used in different senses in different member bodies. A good beginning has been made for a Dictionary of Color Terms. All member bodies except the American Society for Testing Materials have coöperated in this survey. In the A.S.T.M., there is such a diverse usage of color terms that no significant and useful definitions could be formulated.

(*5*) *Survey of Color Tests and Specifications:* This survey has been completed by three of the nine member bodies; surveys by the remaining member bodies, except the American Psychological Association, are in progress. There are no color tests or specifications recognized in the A.P.A.

(*6*) *Review of the Spacing of the Munsell Colors:* The Munsell Book of Color is supposed to show samples of constant hue, samples of constant lightness (value), and samples of constant saturation (chroma); and the members of the various series showing changes only in one of these three attributes are supposed to be separated by color intervals which are visually equal. This book, published by a private company, does not comply with these ideals perfectly. It was suggested in the 1937 Council meeting by individual members of the Council and by some of the delegates from the Optical Society of America that the samples of the Munsell Book of Color be subjected to careful study to determine how well they conform to the intent of the book with the ultimate purpose of producing, if necessary, a book which complies more accurately with that intent. It developed from the efforts of these delegates to obtain official sponsorship for this problem by their Society that the O.S.A. was sufficiently concerned in the solution of this problem to undertake it independently. Accordingly, a special sub-committee of the O.S.A. Committee on Colorimetry was appointed for this study which is now nearing completion. Graphs showing preliminary results of this study are already in use in the Color Laboratory of the Bureau of Agricultural Economics, U. S. Department of Agriculture. The accomplishment of the Council was to stimulate the study of color within one of its member bodies and to obtain for it the active coöperation of delegates from another member body (the American Psychological Association).

(*7*) *Symposium on General Electric Recording Spectrophotometer:* The afternoon session of the 7th Annual Meeting, February, 1938, was devoted to five related papers on this subject. These papers are to be published in a single number (probably September, 1938) of the *Journal of the Optical Society of America*. In this case, the Council is the means through which the members of the O.S.A. will obtain information on this timely and important instrument of color standardization. Arrangements have also been made to supply this issue to all delegates and individual members of the Council including, of course, the delegates from your Society. All member bodies, therefore, will share the benefits of this coöperation.

Some Future Problems for the Council

(*1*) *Vitreous Color Standards:* Already widely used for vitreous products themselves, such standards are becoming increasingly used for paints, textiles, and other materials which are of inferior permanence. A delegate from the Technical Association of the Pulp and Paper Industry mentioned the necessity of a primary reflection standard to supplant the present standard, magnesium oxide (see Minutes of 7th Annual Meeting). May not the solution to this problem be a vitreous sample? Most of the member bodies require information about the availability, permanence, color range, and cost of vitreous enamel samples for working standards of color. This subject would be suitable for a session of some Council meeting; delegates of your Society would be able to supply information needed by all member bodies; the result would be an increased appreciation of the properties of ceramic materials by representatives of those who use color in many forms.

(*2*) *Uniform Color Tolerances:* The substantial loss to industry from rejection of off-color material is too well-recognized to require supporting evidence and often the color tolerance is stricter than the use of the material justifies. The manufacturer would be only too glad to use larger tolerances, but the purchaser in many cases either does not understand the necessary connection between size of color tolerance and cost per accepted unit, or else he uses the color tolerance as a loophole through which to escape an unfavorable contract when there is no other way to escape it. Any system of color tolerance agreed upon in advance between buyer and seller would serve to check the latter type of fraud; but the only way to check losses from unreasonably strict color tolerances is to educate the purchaser. Information on this subject coming from the manufacturer is viewed with suspicion, but the Inter-Society Color Council is in excellent position to exert effective influence upon the purchaser.

Probably three degrees of tolerance, at least, will be required: (1) the minimum tolerance when two pieces of material abut in the same plane; (2) about double the minimum tolerance when two pieces of material are brought together in the finished article with a strip of different color separating them, or when two pieces of material join at an angle; and (3) perhaps four times the minimum tolerance when there is a considerable time interval between the colors (as when it is required to duplicate the color of a trade-mark with sufficient accuracy to insure that the customer will recognize it by memory from trade-marks previously viewed).

The delegates of the American Association of Textile Chemists and Colorists have several times suggested this

problem; and those from the American Society for Testing Materials (representing chiefly the paint, finishes, and dyestuffs industries) expressed their concern formally: "Attention should also be given to the question whether the subject of color tolerances can be handled in a way which is at once fundamental, general, and yet sufficiently simple to be applicable to commercial practice" (see minutes of the 1938 Annual Meeting). Manufacturers of ceramic products (stoves, refrigerators, enameled metal signs, and so on) are by no means exempt from losses due to this cause, and they might find it considerably to their advantage if the Inter-Society Color Council were to encourage a study of the methods of administering color tolerances, and once having found a practical method, to recognize certain definite color tolerances for certain definite typical uses, and to promote acceptance of these tolerances among consumer groups. The manufacturing interests represented on the Council would benefit through increased profits; the consumer interests, through lower prices.

It is planned to start this program of study and education at the 1939 Annual Meeting, the afternoon session of which, under the auspices of the American Psychological Association, is expected to be devoted to a series of related papers on Color Tolerances.

This completes my summary of the past, present, and future activities of the Council. I believe that I have supplied a fairly good basis for an understanding of the Inter-Society Color Council, but I shall be glad to supply additional information if desired.

—DEANE B. JUDD, *Chairman,*
Committee on Color Problems

INTERNATIONAL GLASS CONGRESS, JULY 6 TO 15, 1939

Program and Schedule

(1) The International Glass Congress (Italy, 1933; England, 1936) will be held in Berlin and Munich, Germany, from Thursday, July 6, to Saturday, July 15, 1939.

Papers and reports by foreign and German specialists and also inspection trips will occupy a prominent place in the program of the Congress.

(2) In Berlin, the capitol of the Reich, on July 6 the opening of the Congress will be celebrated in the presence of officials. After the transfer of the presidency two festival addresses will be presented.

The stay in Berlin until Friday, July 7, will permit the inspection of important points of handicraft and industrial manufacture and improvement of glass in the past and present.

(Inspection trip: Kunkel factory on the Pfaueninsel near Potsdam; exhibition, "Brandenburg glass" in the Schlossmuseum; research institute, Osram works.)

The social arrangements will give the participants in the Congress an opportunity for personal contact at the beginning of the Congress.

(3) The trip to Munich will be conducted as an inspection trip of several days' duration. The participants will have the opportunity to become acquainted with important points and factories of the German glass industry in the eastern part of the Reich and in the Bavarian Oberpfalz. A one-day interruption of the trip is planned for Sunday, July 9, in Dresden, where the opening of the exhibition, "New and Old Saxon Glass" in the Grünen Gewölbe (green store), will occur.

(4) The technical group sessions in Munich will be held from Tuesday, July 11 to Friday, July 14. In the technical sessions selected, special subjects in the fields of glass technology, glass art, and glass improvement will be treated.

On Wednesday, July 12, a Kunkel honoring will take place in the honoring hall of the German Museum. The Congress plan also provides for the opening of an "International Glass Production" exhibition.

(5) The final session of the Congress will be held on the forenoon of Saturday, July 15.

(6) The final social meetings of the Congress will be a "Munich Evening," on July 14 at the invitation of the city of Munich and a "Festival of Glass" on the evening of July 15. The favored provincial location of the old technical city, Munich, and its metropolitan character will present the participants in the Congress with the opportunity of making group excursion trips into the Bavarian highlands. The participants in the Congress will have the further opportunity, after the Congress, of becoming acquainted with places and factories in the western part of the Reich which will arouse their special professional and personal interest.

Organization

(1) The management of the International Glass Congress is in the hands of the Congress Managing Committee as follows:

President, General Director Dr. O. Seeling, Fürth/B.
General Treasurer, Director Dr. K. Mey, Berlin.
Chief Manager, Dr. Ing. H. Maurach, Frankfurt a. M.

The *Honorary Presidents* will be selected by the National Committees.

(2) The general supervision and arrangement of the business of the Congress is incumbent upon the (permanent) International Glass Commission which, with the Congress management for the duration of the Congress, forms the Congress Managing Committee.

(3) For the operation of the Congress, the coöperation and support of a Main Committee is assured. This committee is constituted of prominent personalities in science, technology, and industry as well as of influential members of various organizations in the German Reich.

(4) With the Congress Managing Committee is an Organization Committee whose chairman is Director Dr. K. Mey, Berlin, for technology and science of glass; glass art and development; technical glass literature; exhibition matters; entertainment, inspection trips, and travel; and press.

(5) The general arrangements for the operation of the Congress are incumbent upon the individual National Committees of the Congress Managing Committee and the Organization Committee, in conjunction with the Main Committee and the International Glass Commission. The presidents of the National Committees are likewise members of the Congress Managing Committee.

The countries in which National Committees now exist or are yet to be appointed are requested to distribute all contributions for the Congress soon and to collect scientific contributions for the general sessions and for the special group sessions by arrangement with the president of the International Glass Commission (Prof. Dr. W. E. S. Turner, Sheffield). The various countries are also requested to make suitable transportation arrangements for the participants in the Congress.

The complete list of the National Committees and their presidents will be published later.

The coöperation of foreign professional organizations is assured by means of the International Glass Commission and the National Committees.

(6) The participants can include all firms, institutes, groups, and persons who are interested in glass and whose credentials have been approved by the Congress Managing Committee. The admission of foreign participants can be accomplished only through a national committee; the admission of German participants only through the German Congress Managing Committee.

(7) All correspondence should be sent to Internationaler Kongress für Glas, Dr. Phil. K. W. Schulze, Frankfurt a. M., Junghofstrasse 27.

THE PRESIDENT'S COLUMN

MEMBERSHIP IN THE AMERICAN CERAMIC SOCIETY

The number of members of the American Ceramic Society has shown a substantial increase from year to year during the past several years. Unquestionably there are a great number of ceramists and ceramic engineers who have not availed themselves of the opportunities accorded by our Society.

Because the benefits to be derived appear obvious, there is little or no necessity for outlining them in detail. It too frequently happens that many men who are not now members, but who should join the Society, fail to make application for membership, because they say to themselves, "I'll get around to this matter at an early date." The time to avail yourselves of the benefits to be derived from the American Ceramic Society is *now*. Delay will not add to your useful fund of knowledge to be gained from the American Ceramic Society.

Another angle to this problem is that practically every member knows some one who should join our Society. If each member would take the opportunity to mention the American Ceramic Society to one or more of his friends, the result no doubt would be a substantial increase in the membership and thereby a substantial increase in the usefulness of the American Ceramic Society. Why not phone one of your acquaintances or friends today or write him a letter asking his consideration of a membership in the Society? Each member should take a personal responsibility in trying to secure at least one new member between now and the first of the year. Only a few minutes are required to ask an acquaintance for his consideration in this matter, and the results are bound to be encouraging and beneficial.

During the last few weeks, many June graduates have secured work in various ceramic industries. Only a few of these men have made application for membership, and perhaps one reason is that their associates who are now members have neglected to mention to them the gainful purposes of the American Ceramic Society. Why not suggest to one of your assistants the idea of joining now? Dues from now until the end of the year are assessed on a proportionate basis; therefore the amount of the dues is not great.

Whether or not you have an application card available matters little, because it is necessary only to write to Columbus expressing the desire to become a member. An application card will be sent at once.

More corporations should be members. Here again it appears that a rather intensive drive on the part of the membership would result in a greater number of corporations seeking corporate membership.

The strength of our organization may properly be measured by the number of its personnel. The scientific quality and standing of our organization may not properly be measured by the number of members, but it is safe to say that with an increased membership the scientific quality and standing will be proportionately increased.

It may be unfortunate that scientific and engineering societies must conduct certain phases of their activities in a somewhat prosaic manner that may not square with fundamental, pure, or applied sciences, but it is necessary to meet current economic standards and necessities, which is another reason for increasing the number of members. It seems obvious that a large number of members permits greater scope of activities, both from the scientific and economic point of view, and thus permits a wider distribution and a more extensive use of the scientific contributions by the minority membership. Thus it is readily seen that finances enter into the conduct of the affairs of the American Ceramic Society as well as any other similar scientific or engineering society. This particular feature may be strengthened by an increase in our personal and corporate membership.

This is your day to ask a friend or an associate to submit his application for membership.

—Victor V. Kelsey

AMERICANS ARE LEADERS IN CERAMICS*

By Ross C. Purdy

Ladies and gentlemen of the radio audience: You are listening to this broadcast because you wish to learn about the things with which you are already quite familiar through your everyday needs and desires. Almost all educational efforts of this sort are merely the systematizing of our thinking, the correlating of our experiences, and learning how we can be more resourceful. We, as individuals, find pleasure by learning the simple relationships of those things that serve our wants and beautify our surroundings. We also take pride in being resourceful. It is to acquaint you with the fact that Americans have been and now are among the world leaders in the production of ware made of clay, of glass, and of enameled metal and to make plain that among those who are hearing this broadcast there are men and women who, if they would, could make a name and a livelihood by producing useful and artistic objects from clay, glass, or enamels. Such a person would be a ceramist, C-e-r-a-m-i-s-t. The art and technology of producing useful and beautiful things in clay, glass, and glass enamels is known as ceramic art and science.

The word "ceramic," C-e-r-a-m-i-c, may be new to you, but ceramic products are to you very familiar and very essential. The glass in your windows; the glass in your spectacles; the glass bulbs of your electric lights; the glassware on your table; the glass sparklers which many of us wear in place of diamonds—all of these are ceramic products. Of late we have glass brick with which to build homes and factories. There is no one who does not know of the glass disk, 200 inches in diameter, made for use with telescopes; all ceramic products are these.

Brick for construction of buildings; brick for metallurgical furnaces, where heat of high temperatures are essential; and brick for pavements and foundations—these are ceramic products classifiable technically with glass.

With the decorative building blocks known as terra cotta and with the tile for floors and walls most of us are quite familiar; all of these are ceramic products related technically to glass and to common brick.

With the porcelain insulators on high-tension electric lines; with spark plugs on automobile engines; with porcelain bathtubs, lavatories, and toilets; and with porcelain teeth, most, if not all, of us are familiar. These also are ceramic products.

The pipes by which sewers are constructed and the tile by which farms are drained are ceramic products; and so are the common stoneware pots, the most decorative vases, and the most exquisite of china and porcelain, all clayware—ceramic products.

* Radio talk given at the Blue Ridge, N. C., Art Conference, August 2, 1938.

The enameled kitchen sink and the enameled stove and kettle are the same sort of ceramic ware as are the most exquisite and costly cloisonné—all are made by glass fused on to metals. Many automobile name plates are cloisonné enamels—all ceramics.

And, too, the Portland cement of which is built our dams, our foundations for buildings, our highways, and walks—this is a ceramic product.

A concise definition of the term "ceramics" is "the art, science, and technology of producing useful things by heat-treating in kilns or furnaces appropriate mixtures of non-metallic materials."

Now, how, when, and in what manner have Americans been among the leaders in ceramic ware production?

Historical books and current articles have made quite generally known the pottery and brickware made by the American and Mexican Indians. In our museums is preserved the ware made by prehistoric Indians and cliff-dwellers. Historical records show that the colonists made clay- and glass-ware. Prior to the Revolution, there were twenty-six potteries in the Colonies producing ware which is said to be equal in quality to the ware made in those times in Europe and Asia.

Of special interest to the folk from Virginia, North and South Carolina, and from Georgia and Florida is the fact that it was the potters and the pottery product from these southern states that provoked the famous English potters, including Wedgwood, to make white china. Let me read from a book recently written by John Spargo entitled Early American Pottery and China:

"Reference has already been made to the fact that there were potteries in Virginia as early as 1650. By the middle of the next century considerable progress seems to have been attained. In 1745, William Cookworthy, one of the great figures in the history of the pottery industry in England, wrote a letter to a friend in which there is a clear reference to the manufacture of 'china ware' in Virginia: 'I had lately with me the person who hath discovered the china-earth. He had samples of the china-ware of their making with him, which were, I think, equal to the Asiatic. 'Twas found in the back of Virginia, where he was in quest of mines; and having read Du Holde, discovered both the petunse and kaolin. 'Tis the latter earth, he says, is the essential thing towards the success of manufacture. He is gone for a cargo of it, having bought the whole country of the Indians where it rises. They can import it for £13 per ton, and by that means afford their china as cheap as common stoneware.'

"In 1744 Edward Heylyn and Thomas Frye, of the Bow pottery, took out a patent for the manufacture of 'china ware.' In the specifications they stated that the material used was 'an earth, the produce of the Chirokee nation in America, called by the natives *unaker*.'

"We know that in 1765 the Worcester and Bristol manufacturers imported clays from South Carolina. We know that there was the beginning of a pottery industry in South Carolina contemporaneously with the exportation of clay, and that fact tends to confirm our belief that much the same sort of thing occurred in Virginia.

"It will surprise most Americans to-day to learn from no less an authority than Josiah Wedgwood himself that the colonies in 1765 were a market for the more costly wares made at the British potteries, yet such is the fact. 'We cannot make anything too rich and costly,' wrote Wedgwood with reference to this market. He continued: 'This trade to our Colonies we are apprehensive of losing in a few years, as they have set on foot some Pottworks there already.' "

Following the Revolution and prior to 1799, there were thirteen more potteries started in the United States, many of them by men not traditional potters. They made pottery much as Baron Stiegel, in 1750, at Lancaster, Pa., made flint glassware that so radically revolutionized the styles in glass tableware. Stiegel was an iron worker who, by use of common knowledge, demonstrated that the glass-ware makers possessed no secret and had no corner on the art of glassware production.

The slip-decorated pottery of the Pennsylvania and New England colonists (81 factories, all established prior to 1852) was made by potters native-born of foreign parentage but not necessarily born into the trade or craft.

Of the 150 other potteries which are known to have been established between the years 1800 and 1850, the most successful and enduring ones were started and managed by farmers, apothecaries, and merchants, rather than by men born into the trade and into the art of pottery business. So it was with the 120 potteries which were later established, between the years of 1850 and 1876.

The Centennial Exposition in Philadelphia in 1876 did much to awaken Americans to the fact that in the United States there were knowledge, skill, and materials to produce in competition with the world's best. Lenox china followed by the fine tableware of Onondaga, Shenango, Scammell, and others, has no superior. The artware of Rookwood is equal to the world's best. The fine crystal and colored glassware, the enameled jewelry, and the glazed terra cottas of American ceramists have for the most part led the world.

Americans were the originators and leaders in most of the utilitarian ware, such as electric insulators, heat insulators, refractories, sanitary ware, and abrasive grinding wheels.

The American high wages, the highest in the world, have compelled ceramic engineers to be the leaders of the world in inventing equipment and processes. Mass production, at low cost per unit of ware made with high wages and with improved quality and superiority in appearance, has brought the necessity for using the combined skill and knowledge of engineers, scientists, and artists. Thus it is that twenty-four American universities have ceramic degree courses of instruction: among others, Georgia, Alabama, North Carolina, and Virginia.

It was an American realization only forty years ago that there must be collaboration in the promotion and recording of results of ceramic research. Now, wherever ceramic ware production is of economic importance there are ceramic schools and national ceramic societies. By these agencies, the means of production of ceramic ware of any required quality and for any given purpose is a matter of public record.

Americans have been and now are out in front in ceramic ware production. No longer are there mysteries concerning ceramic formulas or processes. Ceramic concerns and countries are differentiated by business abilities and process inventions plus fundamental engineering and scientific knowledge.

Americans are leaders in ceramic ware production—"Ceramics," C-E-R-A-M-I-C-S, "the art, science, and technology of producing with fire useful things from non-metallic minerals."

FOURTH ANNUAL COÖPERATIVE ART CONFERENCE, BLUE RIDGE COLLEGE, N. C.

August 8, 1938

Location: Sixteen miles east of Asheville on Route 70, near the town of Black Mountain, across the valley from Mt. Mitchell, and 2740 feet up the side of a 5000-foot mountain. The college campus faces north.

Summer Activities: In the winter these buildings and campus are used by the Black Mountain College; in the summer for conferences under the auspices of Blue Ridge College, Inc.; seventeen (17) conferences of two weeks each are being held this summer.

Capacity: In the two weeks before the Art Conference there was a conference attended by 600 delegates, all housed and fed on the campus.

Hotel Rates: European plan; room with bath $2.50; meals, cafeteria; hotel service or club plan at special rates.

Recreational Facilities: Gymnasium, swimming pool, lake for swimming and boating, golf, scheduled mountain hikes, horseback riding.

Museum Attractions: Biltmore estate of Vanderbilt and Asheville Museums.

1938 Ceramic Art Conference: Mrs. Melchior tried desperately to arrange a two-day program to be given under the auspices of the University of North Carolina, N. C., State Department of Public Instruction, Blue Ridge, Inc., and the American Ceramic Society. This Society was to supply the program, and Prof. R. M. Grumman of the Univ. of N. C. and Dr. W. D. Weatherford were to contact the school teachers and the ceramic artists. This Society failed to do its part, hence the others had nothing to sell; yet there were 60 teachers attending, chiefly from distant states, from Massachusetts in the east to North Dakota in the northwest.

Ceramic Art Program, August 2 and 3: Mrs. Melchior had scheduled W. B. Stephen of Pisgah Pottery and had secured moving pictures from Corning Glass and Onondaga Pottery and Prof. Russell Smith of the Fine Arts Dept., Univ. of N. C., Chapel Hill. A broadcast and a lecture by me, as General Secretary of the American Ceramic Society, were scheduled and given.

En route to Blue Ridge, contact was made with Hewitt Wilson, TVA Ceramic Laboratory, Norris, Tenn., to secure services of George W. Fichter, potter, and Patricia J. Eakin, ceramic artist. The lectures and demonstration given by these two so delighted all who heard them that informal discussions and demonstrations were repeatedly given. Dr. Weatherford had Fichter and Eakin repeat their lectures and demonstration to about 100 post-graduate students who had come to Blue Ridge from all parts of the U. S. A.

In addition to Fichter and Eakin, we were fortunate to have D. Bruce Doyle, who has studied ceramic art with Margaret Cable, Grand Forks, N. D., and with Glen Lukens of the Univ. of Southern Calif. Doyle, who is teaching ceramic art under Federal auspices to Sioux Indians, gave an interesting and instructive talk.

Altogether we had a fine and apparently very instructive program.

Recommendations: Because Blue Ridge has facilities at moderate cost, with delightful recreational advantages, in a scenic mountain setting unexcelled, near the famous Biltmore Estate Museum, and a short way from the Spruce Pine clay, feldspar, and kyanite mines and mills; and because the State Department of Public Instruction, the Univ. of N. C. Extension Department with R. M. Grumman, Director, and the Blue Ridge, Inc., with Dr. Weatherford directing, have the promotional machinery and contacts, and have earnest desires to schedule a ceramic art conference each year, the American Ceramic Society should be a joint sponsor and provide the program.

A more effective and delightful opportunity can not be found to promote ceramic art and science.

Respectfully submitted,
—R. C. PURDY, *General Secretary*

Another Blue Ridge, N. C., Conference*

Dear Dr. Purdy:

I wish you could have been here on the night of August 12 to see the dedication ceremonies of the Rhododendron Theatre. The Playcrafters from Appalachian State Teachers College at Boone, N. C., presented with the same cast the little play called "Aria da Capo" with which they won the award for the best play presented in the Annual Dramatic Festival at the University of North Carolina. We also had Bascom Lamar Lunsford, founder and director of the Asheville Folk Festival, the instructor in balladry and folk dancing at the Cincinnati Music Hall, and a member of the International Commission on Folk Arts, as the principal speaker.

—W. D. WEATHERFORD, *President*

* Letter received August 17, 1938.

PORCELAIN ENAMEL INSTITUTE FORUM

F. E. Hodek, Jr., General Porcelain Enameling & Mfg. Co., Chicago, Ill., Chairman of the Forum Committee and President of the Porcelain Enamel Institute, reports that the program for the Third Annual Porcelain Enamel Institute Forum is practically complete. This Forum, sponsored by the Porcelain Enamel Institute, will be held at the University of Illinois, October 12 to 14, 1938.

The tentative subjects to be discussed are as follows:

Wednesday Afternoon, October 12: (1) Review of the Industry and (2) The Institute and the Plant Man.

Wednesday Evening, October 12: Lighting Exhibit.

Thursday Morning, October 13: (1) Tentative Tests for Abrasion Resistance, (2) Factors Affecting Sag-Resistance Properties of Enameling Iron, and (3) Methods for Testing Enamel Stock.

Thursday Afternoon, October 13: (1) Discussion of One Cover-Coat Ware, (2) Ball Milling Practice, and (3) Sources of Enamel Shop Waste.

Friday Morning, October 14: Division Sessions: (1) Hollow-Ware Session: (*a*) Black Specking of Hollow-Ware and (*b*) Fabrication and Trimmings; (2) Cast-Iron Session: (*a*) Automatic Blasting and (*b*) Source and Elimination of Black Specks in Dry-Process Enameling; (3) Sheet-Iron Session: (*a*) Color Matching of White Parts, (*b*) Circulating Ground-Coat Systems, and (*c*) Burning Tools for Enameling.

Friday Afternoon, October 14: (1) Automatic Spraying and Brushing Equipment, (2) Automatic Welding, and (3) Relationship of Some Welding Practices with Certain Enamel Defects.

Before the close of this Forum, Mr. Hodek will announce plans for the Fourth Annual Porcelain Enamel Institute Forum.

In addition to the program outlined, the Institute will have as its guests at this Forum a group of members of the Institute of Vitreous Enamellers of England. Three individuals from this group are also scheduled to talk during these sessions; Bennett Chapple, Vice-President, American Rolling Mill Co., well known in the porcelain enameling industry, will be the guest speaker at the banquet to be held Thursday evening.

ANNUAL MEETING OF CERAMIC ASSOCIATION OF NEW YORK

The Annual Meeting of the Ceramic Association of New York will be held at Alfred University, Alfred, N. Y., Friday, October 7, 1938. The program will consist primarily of the presentation of the research results of the Ceramic Experiment Station of the New York State College of Ceramics for 1937–1938. It will deal chiefly with heavy clay products research, but whiteware, glass, refractories, and enamels will also be presented. Everyone interested is welcome.

OFFICERS OF KERAMOS FOR 1938–1939

President: D. G. BENNETT, Mellon Institute, Pittsburgh, Pa.

Vice-President: R. F. SHERWOOD, United Feldspar Corp., New York, N. Y.

Grand Secretary: C. M. DODD, Missouri School of Mines, Rolla, Mo.

Grand Treasurer: S. R. SCHOLES, N. Y. State College of Ceramics, Alfred, N. Y.

Grand Herald: A. F. GREAVES-WALKER, Univ. of North Carolina, Raleigh Unit, Raleigh, N. C.

WATCH YOURSELF GROW
BY GETTING MORE NEW MEMBERS

WHETHER you want to **SELL OR HEAT TREAT** your glass products, **SIMPLEX** controlled atmosphere annealing and decorating lehrs should be your first consideration.

WHY?

BECAUSE this new **READY HEAT UNIT LEHR** is fast becoming the **No. 1 FAVORITE** among glass manufacturers everywhere.

FRAZIER-SIMPLEX, INC.

ENGINEERS

436 E. BEAU STREET • WASHINGTON, PENNA,, U. S. A.

"CERAMIC" COLORS *For Satisfaction in Production*

COLORS

For Enamels:—Colors and Oxides; Smelter Oxides; Graining, Printing, Banding, and Screening Colors.

For Pottery:—Glaze and Body Stains; Underglaze and Overglaze Colors for Banding, Spraying, and Screening; Fritted Glazes and Fluxes.

For Glass:—Enamels; Vitrifiable Colors for Banding, Spraying, and Screening; Printing Colors; Fluxes; Batch Colors.

Decorating Supplies:—Printing Tissue; Screening Oils, French Fat Oil, Oil of Copaiba, Balsam Fir, Damar Varnish; Brushes; Knives and Spatulas; Grinding Mills.

CHEMICALS

Aluminum Hydrate
Ammonium Carbonate
Antimony Oxide
Antimony, Black Needle
Barium Carbonate
Barium Chromate
Bone Ash
Cadmium Carbonate
Cadmium Oxide
Cadmium Sulphide
Calcspar
Chrome Oxide, Green
Clay, Vallendar
Cobalt Oxide, Black
Cobalt Sulphate
Copper Oxides
Iron Chromate
Iron Oxides
Kryolith
Lead Chromate
Magnesium Carbonate
Manganese Dioxide
Nickel Oxide, Black
Nickel Oxide, Gray
Nickel Sulphate
Potassium Bichromate
Potassium Nitrate
Potassium Permanganate
Powder Blue
Rutile, Powdered
Selenium
Sodium Aluminate
Sodium Antimonate
Sodium Bichromate
Sodium Silicate
Sodium Silico Fluoride
Sodium Uranate
Tin Oxide
Titanium Oxide
Uranium Oxide, Orange
Uranium Oxide, Yellow
Zirconium Oxide

WENNING CERAMIC COLORS TRADE MARK

"CERAMIC" COLORS

CERAMIC COLOR & CHEMICAL MFG. CO., NEW BRIGHTON, PENNA.

ORTON STANDARD PYROMETRIC CONES

For Forty-Two Years
The American Standard for
Control of Ceramic Heat Treatment

THE EDWARD ORTON, JR.,
CERAMIC FOUNDATION
George A. Bole, D.Sc., *Manager*

Laboratories & Office
1445 Summit Street—Columbus, Ohio

WANTED TO BUY OUT-OF-PRINT

Journals of
The American Ceramic Society

June, 1922, Part II
1923 Yearbook
1924 February
1933 January
February
1934 January Bulletin
February Journal
January Journal
March Bulletin
April Bulletin
1938 April Bulletin, June Bulletin

Communicate with the Officers of

THE AMERICAN CERAMIC SOCIETY
2525 North High Street **Columbus, Ohio**

U. S. Bureau of Mines
Approval No. 2118.
No. 200 for Type A Dusts.

GOGGLES . HELMETS
RESPIRATORS

Willson Protection guards ceramic workers against eye, nose, throat and lung hazards. The line includes U. S. Bureau of Mines Approved Respirators for Type A and Lead Dusts.

For Complete information write

DOUBLE WILLSON
PRODUCTS INCORPORATED
READING PENNSYLVANIA

THE SHARP-SCHURTZ COMPANY

CHEMISTS FOR THE CERAMIC INDUSTRY

WE HAVE FULLY EQUIPPED LABORATORIES AT

LANCASTER, OHIO U. S. A.

EMERSON P. POSTE

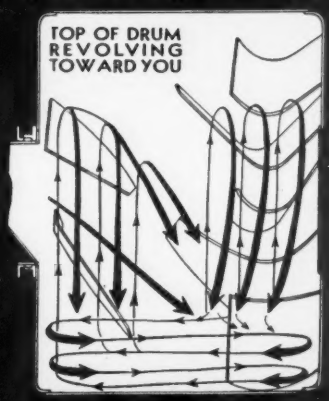
CONSULTING CHEMICAL ENGINEER

ANALYSES: CERAMIC RAW MATERIALS AND PRODUCTS, FUELS, IRON AND STEEL, ETC.

SPECIAL INVESTIGATIONS: PHYSICAL AND CHEMICAL TESTS ON ENAMEL, ETC.

309 McCALLIE AVE.,
CHATTANOOGA, TENN.

The mixing action that will speed your production and improve your product!



RANSOME

Write for Bulletin No. 503

An exclusive feature of Ransome MIXERS

GLASS
ENAMEL FRITS
REFRACTORIES

Industrial Division: RANSOME CONCRETE MACHINERY CO.
DUNELLEN, NEW JERSEY

THE MARK OF QUALITY

THE WORLD'S PEMCO FINEST

THE PORCELAIN ENAMEL & MFG. CO.
PEMCO and EASTERN AVES., BALTIMORE, MD.

Tunnel, Truck and Humidity Dryers
for—
Dry Pressed Electrical Porcelain
High Voltage Electrical Porcelain
Sanitary Porcelain
Floor and Wall Tile
Abrasive Wheels
Glass Pots and Blocks
Refractory Brick and Shape
Also Stove Rooms and Mangles for General Dinnerware

PROCTOR & SCHWARTZ, INC.
The Largest Builders of Drying Machinery for Industry
Seventh Street & Tabor Road, Philadelphia, Pa.

BACK NUMBERS
OF
JOURNAL OF AMERICAN CERAMIC SOCIETY
AND ALL IMPORTANT MAGAZINES FROM THE WORLD OVER

We furnish single copies, volumes and sets or photostat reproductions of specific sections, reasonably and promptly

WRITE, PHONE OR WIRE PERIODICALS DEPARTMENT

THE H. W. WILSON COMPANY 950 University Avenue, New York

McDANEL REFRACTORY PORCELAIN COMPANY

Manufacturers of

PORCELAIN TUBES PROTECTION TUBES
INSULATING TUBING and BEADS

BEAVER FALLS PENNSYLVANIA

All Types of Circular and Straight Tunnel Kilns

SWINDELL-DRESSLER CORPORATION

Post Office Box 1888 **Pittsburgh, Pa.**

Lehrs and Enameling Furnaces, Electric and Gas Fired

Full Details Furnished on Request

BORAX *Guaranteed 99½%–100% Pure* **BORIC ACID**

Select the Brand which has back of it years of *successful use* by experienced Ceramists

Pacific Coast Borax Co., New York

Chicago 20 Los Angeles

PURE WYOMING BENTONITE

(Colloidal Clay)

An ideal medium of high absorption properties, used to increase plasticity of low plastic or non-plastic minerals or clays—also excellent for use in preparing suspensions, emulsions and for the addition of bond.

THE WYODAK CHEMICAL COMPANY, Miners and Shippers

4600 E. 71st St. Cleveland, Ohio

Branches: New York—Detroit—Chicago—Los Angeles—Richmond—St. Louis—Milwaukee—Portland—San Francisco

European Concessionaires—The District Chemical Co., 52–54 Leadenhall St., E.C. 3, London, England. Mines: Upton, Wyo.

THREE ELEPHANT

REG. U.S. PAT. OFF. REG. U.S. PAT. OFF.

AND BORIC ACID

GUARANTEED OVER 99.5% PURE

AMERICAN POTASH & CHEMICAL CORPORATION

70 Pine Street, New York

BETHLEHEM PRODUCTS for the Ceramic Industry

88-80 CASTINGS

to save maintenance on grinding equipment

BETHLEHEM ABRASIVE-RESISTING PLATES

for chutes, hoppers, dump-car bottoms

BETHLEHEM TOOL STEEL

for dry press and repress liners

WIRE ROPE

for all excavating and material-handling equipment

Also—Light Rails, Steel Ties and Track Equipment

BETHLEHEM STEEL COMPANY

General Offices BETHLEHEM STEEL **Bethlehem, Pa.**

District Offices: Albany, Atlanta, Baltimore, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Columbus, Dallas, Detroit, Honolulu, Houston, Indianapolis, Johnstown, Pa., Kansas City, Los Angeles, Milwaukee, Nashville, New Haven, New York, Philadelphia, Pittsburgh, Portland, Ore., Salt Lake City, San Antonio, San Francisco, St. Louis, St. Paul, Seattle, Syracuse, Toledo, Tulsa, Washington, Wilkes-Barre, York.

Export Distributor: Bethlehem Steel Export Corporation, New York

PRODUCTS *of Proven Merit*

— SINCE 1909 —

THERE is satisfaction in knowing that the colors you buy for your products are of finest quality and consistently dependable.

When you buy Vitro Colors, Opacifiers and Chemicals you buy products of merit.

✦ ✦ ✦

Opacifiers and Oxides for Enamels
Acid and Sulphide Resisting Glass Colors
Modern Glaze Stains and Overglazes
Chemicals for Ceramic Use

THE VITRO MFG. CO.

Corliss Station, Pittsburgh, Pa.

California Branch: 16 California St., San Francisco

VITRO PRODUCTS

THE HOUSE OF HOMMEL
SUPPLIERS OF ALL CERAMIC NEEDS

Quality
FRITS
COLORS
CHEMICALS
Stocked for
IMMEDIATE SHIPMENT

THE
O. HOMMEL CO.
Quality First - Since 1891
209 Fourth Avenue Pittsburgh, Pa.
LET OTHERS IMITATE -:- WE ORIGINATE

Pacific Coast Agents
L. H. BUTCHER CO.
Los Angeles - Salt Lake City - San Francisco - Portland - Seattle

CLAYS
English China and Ball

TALCS
for
HEATING ELEMENTS
CERAMIC BODIES
SAGGER USES

Ceramic Specialties Include
Whiting : Paris White : Magnesite
Cornwall Stone : Barium Carbonate
Zinc Oxide : Enameling Clays : Etc.

HAMMILL & GILLESPIE, INC.
Importers since 1848
225 Broadway New York

Ceramic Service?
We Give It

We Manufacture–
Pins—all shapes and lengths
Stilts
Thimbles
Spurs
Saggers
Crucibles
Tile for Decorating Kilns

We Sell–
Ball Clays—Kentucky
Sagger Clays—Kentucky
Ground Fire Clay—Ohio, Pennsylvania
Bitstone—all sizes
Fire Brick
Imported Paris White
Domestic Whiting
Georgia Kaolin
Modeling Clay

THE POTTERS SUPPLY COMPANY
EAST LIVERPOOL, OHIO

THE MAN
behind the man behind the gun!

● Back of every single piece of DeVilbiss Spray-Finishing Equipment stands DeVilbiss service . . . A service forged from 50 years of highly specialized experience.

DeVilbiss service is more than words. It's a man! The DeVilbiss *spray expert* who calls on *you!* He knows his stuff! Graduated from the DeVilbiss training school. Learned more from years of experience with tough spraying problems. Knows how to spray things quicker, better, more economically.

Back of him are DeVilbiss engineers. To them the credit for developing the world's finest, most complete line of spraying equipment. Not by chance! But through painstaking research, experiment, engineering.

But, maybe you have an unusual spraying problem! Need special equipment! Want it quick! Then wire, or telephone. A DeVilbiss *expert* will soon be on his way—willing and able to help you. No obligation!

The DeVilbiss Company, 325 Phillips Avenue, Toledo, Ohio.

THE MOST ADVANCED TYPE OF SPRAY-PAINTING AND FINISHING EQUIPMENT, EXHAUST SYSTEMS, AIR COMPRESSORS, HOSE AND CONNECTIONS.

DE VILBISS SPRAY SYSTEMS

1888 · FIFTY YEARS OF QUALITY PRODUCTS · 1938

COMPLETE MEMBERSHIP ROSTER

.....

WILL BE PUBLISHED IN THE OCTOBER BULLETIN

This ROSTER will be the "Who's Who" of Ceramic Technology; therefore, the name of every ceramist should be listed.

Advertising will be especially effective in the October Bulletin because the circulation will be greatly increased and because this Roster, as well as the Constitution, By-Laws and Rules, of the Society, which will also be published in this issue, will be referred to constantly.

For advertising rates see page 13

AMERICAN CERAMIC SOCIETY
2525 N. HIGH ST. COLUMBUS, OHIO

CERAMIC PROGRESS

Progress in ceramic industry depends on new products, economies in production and new applications of ceramic materials . . . . Harshaw "Uverite," glaze stains and glass enamels are ceramic progress.

UVERITE—Harshaw's new opacifier for porcelain enamel . . . . "Uverite" effects real economies in production. "Uverite" is comparable to tin oxide in gloss, color, whiteness and scratch resistance. "Uverite" opens new fields to the ceramist.

GLAZE STAINS—The modern trend to colorful dinnerware is largely due to the appeal of new glazes . . . . Harshaw glazes, both bright colored and pastel, are widely used on this new ware.

GLASS ENAMELS—The silk screen process made possible large scale decoration of glass . . . . Harshaw acid resistant and alkali resistant glass enamels were developed to meet the requirements of this industry.

THE HARSHAW CHEMICAL CO.

Manufacturers, Importers, Merchants

Offices and Laboratories: Cleveland, Ohio

Quality products since 1892

New York, Philadelphia, Chicago, Detroit, Pittsburgh, Cincinnati, East Liverpool, Los Angeles, San Francisco

Works at Cleveland and Elyria, Ohio, and Philadelphia, Pa.

BEHIND YOUR GOOD TELEPHONE SERVICE IS THE *Constant Courtesy* OF

THE VOICE WITH A SMILE

THE MAN ON THE JOB

THE MEN AND WOMEN IN THE TELEPHONE OFFICE

This country is entitled, in good times and bad, to the best telephone service at the lowest possible price.

A great factor in accomplishing this is the real spirit of service that has become a tradition among telephone men and women. Courtesy and efficiency are important words in the Bell System.

BELL TELEPHONE SYSTEM

H. C. SPINKS CLAY COMPANY

Miners and Shippers of

BALL, SAGGER AND WAD CLAY

NEWPORT, KY.

Paris, Tennessee
August 18, 1938

Mr. Pete Potter
Comfortable Sanitary Pottery Mfg. Co.
Pottsville, Ohio

Dear Pete:

This is the season of all work and no play around the Tennessee clay mines, so not much small talk for you.

All I can say is that we are right on the BALL, and the SAGGER and WAD too, filling the sheds and watching the quality, and it takes a lot of hustle and attention to keep the costs down where they have to be because well do you know that SPINKS CLAYS are sold at reasonable prices.

See you at the Bedford Springs Meeting of the American Ceramic Society, September 15th.

Sincerely,

Dick Carothers

General Manager
H. C. SPINKS CLAY COMPANY

RBC:MLN

Prove the superior quality of

M and T

SODIUM ANTIMONATE

Every lot of M and T sodium antimonate must pass eleven exacting physical, chemical, and enameling tests before it is shipped from the factory.

These tests prove the absolute uniformity of both the product and its performance. They prove that M and T sodium antimonate is entirely free from chemical or physical variations—that it is always of the highest quality which selected raw materials, scientifically processed, can produce.

The many users of M and T sodium antimonate take no chances when they continually choose this superior product.

METAL & THERMIT CORPORATION, 120 BROADWAY, NEW YORK, N. Y.